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HEARINGS

BEFORE THE

COMMITTEE ON IRRIGATION OF ARID LANDS

OF THE

HOUSE OF REPRESENTATIVES

RELATING TO

PROJECTS FOR THE IRRIGATION OF ARID LANDS UNDER THE NATIONAL IRRIGATION ACT

AND

THE WORK OF THE DIVISION OF IRRIGATION INVESTIGATIONS OF THE AGRICULTURAL DEPARTMENT IN CONNECTION WITH IRRIGATION OF ARID LANDS.

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IRRIGATION OF ARID LANDS.

COMMITTEE ON IRRIGATION OF ARID LANDS,
Friday, January 13, 1905.

The committee met at 10 a. m., Hon. Charles Q. Tirrell in the chair.

The CHAIRMAN. I understand that a number of gentlemen are present this morning interested in what is known as the Klamath project in California and Oregon (H. R. 17250, providing for the construction of irrigation and reclamation works in certain lakes and rivers), and on that account I would suggest, if there is no objection on the part of any member of the committee, that we take the matter up.

In the first place, inasmuch as this bill was introduced by Representative Gillett, of California, I would suggest that we hear from him.

Mr. GILLETT. I waive my right to Mr. Lippincott. I will say something later on, but at the commencement of the discussion I would like to have him explain it.

Mr. MARSHALL. I suggest that you tell us what you want to do by this bill.

Mr. GILLETT. I will state that later on.

STATEMENT OF MR. J. B. LIPPINCOTT, SUPERVISING ENGINEER, UNITED STATES GEOLOGICAL SURVEY.

Mr. LIPPINCOTT. With your permission I will use this map (indicating), which is the official survey of the region in question by the United States Geological Survey.

I presume that it will be desirable for me to explain something of the physical conditions in this vicinity and then refer to the legislation.

The northeastern portion of California has sometimes been called the undiscovered California. The project in question, known as the Klamath project, lies on either side of the line that divides the State of Oregon from the State of California. This line (indicating) east and west across the center of the map is the State line. It is a plateau region, where there are a great many lakes. The upper Klamath Lake contains 70,000 acres, the Lower Klamath Lake contains 25,000 acres, and has 60,000 acres of marginal swamps. Rhett, or Tule Lake, contains 100,000 acres and is a shallow lake with an average depth of 12 feet. The rainfall in this region is in the neighborhood of 15 inches and successful agriculture requires irrigation.

It is possible, by the proper manipulation of these lakes, to reclaim approximately 300,000 acres of land, which would be about equally divided between the State of California and the State of Oregon.

Mr. MARSHALL. How many thousand acres?

Mr. LIPPINCOTT. Three hundred thousand acres, and that is exclusive of 90,000 acres lying in the Klamath Indian Reservation, which land would probably ultimately be brought into harmony with the reclamation of the other portion of the work, although we can not do it now.

In order to properly carry out this project it will be necessary to interfere with interstate navigable waters, and, as you gentlemen know, interstate navigable waters are protected by special acts of Congress. The upper Klamath Lake is navigable to a limited extent. There is no great commerce, perhaps one or two small boats. There is a fall of 56 feet in the Klamath River immediately at the outlet of the upper Klamath Lake, and below this fall a great plain spreads out extending into California, so that this upper lake is at an elevation sufficiently to drive the water in canals to the margins of the plain. Beginning at the falls the Klamath River is navigable, and is navigated slightly by two or three small boats that pass to the Lower Klamath Lake and through the Lower Klamath Lake into California. At a certain point this lower swamp and lake system flows over a rimrock, and that is the head of the Klamath River proper. Below that the Klamath River becomes a precipitous cascade until it reaches the Pacific Ocean and is not navigable, so far as I know, after leaving this lake region.

The situation is rather complex, and is such that probably this enterprise could not be fully developed by any private interest, because this project requires special legislation from the State of California, the State of Oregon, and the United States Congress. We therefore have an enterprise which is peculiarly a Federal enterprise, and it is probable that no adequate development of this country can ever be accomplished except by the Federal Government, because of the interstate character of the water and because of the special legislation that is requisite for the carrying out of the enterprise.

Now, for instance, the Lower Klamath Lakes are interstate. The title to the beds of those lakes is somewhat in doubt. The State of Oregon and probably the State of California each would claim that they own the beds of those lakes, so that if we should by a system of drainage uncover the beds of those lakes there might result a conflict as to the title of the land, and in order to meet that situation the governors of both California and Oregon, both of which gentlemen are thoroughly in sympathy with this movement and in fact are urging us to make this construction—the governors of both States have recommended in messages to their legislatures that the respective States cede any right or claim that they may have to the lake-bed lands to the United States Government, which lands are to be disposed of under the provisions of the reclamation act to settlers who actually reside on the lands. I have messages this morning both from Oregon and California which set forth that such bills are now pending before both legislatures, and in a peculiar way the possibilities of constructing this project are dependent on the joint cooperation of both those States and the Federal Government, so that, because of the short sessions of the legislatures and the short session of Congress, there is very great necessity, provided it is desirable for the Government to build this project, for prompt action in the matter.

I might say that the chief engineer of the reclamation service and Mr. Bien, his legal adviser, and the assistant engineer have all been over the ground and examined the surveys which we have made, and

they feel inclined from the standpoint of the reclamation service to indorse this project and to construct these works, provided the Congress of the United States and the legislatures of those two States express their desire or willingness to have this work done by passing the necessary legislation.

I would like to say further that this is not only one of the greatest opportunities in arid America for the reclamation of a great area of country which is now almost unproductive—productive only as a cattle range in large part—but is also a great project that can be constructed at a relatively low expense.

We have here an enormous lake (the upper Klamath) which is a natural storage reservoir, which is at sufficient elevation to drive the water through the irrigating canals around either side of the basin, and we have arable lands beginning within 1 mile of the outlet of that lake. The only thing that is provided for in this bill is that Congress give to the Secretary of the Interior the right to make this diversion.

(At this point Hon. Frank W. Mondell took the chair.)

Mr. LIPPINCOTT. So far as the Army engineers are concerned, I have no written credentials from them, but I will say that they have been twice notified of our work in this locality and of the bill which it was proposed to introduce in Congress, and I have personally seen General McKenzie, the Chief of Engineers of the U. S. Army, and discussed the situation with him. I understand him to indorse our proposition; at least he raised no dissenting voice.

There is another feature that I should explain to the committee in connection with this project, and that is, that we began this investigation in the fall of 1903, and we then sent engineers into the field to make the preliminary study of the situation. In January, 1904, a party of gentlemen organized a corporation known as the Klamath Canal Company. This corporation began surveys, as I understand it, subsequent to our original investigations, and have begun a partial construction of some irrigation works. They have not irrigated any land; they never had any water in their canal, so far as I know. In the spring of 1904 we reentered the field with larger surveying parties, have projected our lines throughout the country and made our estimates, and on the 1st of July, 1904, the areas indicated within the blue and green lines [indicating on map] were withdrawn under the terms of the reclamation act.

There are two old canals in this region, one diverting water from the Upper Klamath Lake to irrigate about 5,000 acres of land. This canal is locally known as the Ankeny Canal. Mr. Ankeny, a brother of the Senator, has been most active in his support of the construction of this work and has given us an option on his canal system at a low figure; what we consider a very reasonable figure, Another canal from the Lower Klamath Lake to irrigate about 5,000 acres of land is known as the Adams Canal. Mr. Adams has been one of the most active supporters of this Federal movement, and has attended the State convention in Portland favoring the Government irrigation in Oregon and expressed his approval of this Klamath proposition. However, there is something of friction between the proposition to construct the Government canal and to construct it as a private enterprise by the Klamath Canal Company, but I can assure this committee that there is practically a unanimous opinion among the landowners of this region and the people who live in that section for the construction

of this work as a public enterprise. The people who live there are very anxious for us to proceed, and have so stated their views, and, as I understand it, the Congressional representatives from that section, who of course can speak for themselves, are favorably inclined to it.

Mr. TIRRELL. How much of a population is there now?

Mr. LIPPINCOTT. There is not a very large population. I will say 500 or 600 people were at our meeting at Klamath Falls held to receive Mr. Newell when he arrived there.

Mr. BELL. Where is the nearest railroad to this section?

Mr. LIPPINCOTT. The main line of the Southern Pacific from Sacramento to Portland passes up through Shasta Valley, as indicated by this line [indicating on map]. A branch line runs about 30 miles from the lake region. We have been advised by the railroad companies that as soon as it is determined that we shall build in that region the railroad corporations will all probably construct in there also.

In reference to the private interests in that section we certainly have no desire or inclination to treat one element of the community with more consideration than another, and it is my opinion, so far as that goes, that the gentlemen should be reimbursed for what they have legitimately expended in that section in building canals, and should then be permitted to retire from the field without loss.

Mr. TIRRELL. Can you utilize what they have done in your work?

Mr. LIPPINCOTT. No, sir; as far as the Klamath Canal Company work is concerned.

Mr. TIRRELL. It is practically so much thrown away?

Mr. LIPPINCOTT. Yes, sir.

Mr. BELL. Is the reclamation act broad enough to permit the Secretary of the Interior to acquire their rights and to compensate them for the work done, or will it require additional legislation?

Mr. BIEN. I think the law covers that.

The CHAIRMAN. How much land is there under irrigation by the Ankeny Canal?

Mr. LIPPINCOTT. Five thousand acres.

The CHAIRMAN. How long has the canal been constructed?

Mr. LIPPINCOTT. Fifteen years.

The CHAIRMAN. How much land could be irrigated under it?

Mr. LIPPINCOTT. We could use the Ankeny and extend it so as to irrigate a great deal more.

The CHAIRMAN. Is practically all the land now under the Ankeny Canal under irrigation?

Mr. LIPPINCOTT. No, sir. This canal is not a very large canal and it is irrigating all the land that it can serve.

The CHAIRMAN. By reason of the capacity of the canal?

Mr. LIPPINCOTT. Yes, sir.

Mr. TIRRELL. Are these corporations or individuals who own the canals?

Mr. LIPPINCOTT. Corporations.

Mr. HITCHCOCK. Is there any local opposition to the movement of which this bill is a part?

Mr. LIPPINCOTT. So far as the people who are land owners in that section are concerned, the community at large, there is no difference of opinion. The Klamath Canal Company, which is the only opposition to this movement in that section, might possibly object to the bill, but their diversion of water from that lake is precisely the same thing that we propose to do and which we consider necessitates this bill.

'he CHAIRMAN. How much have they done? How much money 'e they expended?

Ir. LIPPINCOTT. I think it is considerably under $50,000 for con- ıction.

'he CHAIRMAN. Are they prosecuting their work at this time?

Ir. LIPPINCOTT. They have been during the summer to this extent; y are running a tunnel to tap this lake. This tunnel is a small one, t big enough for a man to work in, and they are working that tun- from three or four headings.

Ir. HITCHCOCK. And they began after your engineers were in the d?

Ir. LIPPINCOTT. As I understand it, they incorporated their com- ıy about the 1st of January, 1904, and our engineers were in the d in the fall of 1903.

Ir. MARSHALL. What can they do with the lands withdrawn?

Ir. LIPPINCOTT. Contracts have been made with the landowners ɔ own lands in private ownership, and such contracts were entered ɔ prior to any declaration on the part of the Government of the sibility of constructing this project as a governmental project.

Ir. MARSHALL. Will they have to cross any of the lands withdrawn 'each their tract?

Ir. LIPPINCOTT. Their canal, as far as I know, is parallel with the keny Canal, and perhaps 3 or 4 feet higher in elevation, and it is ctically all located on private land.

Ir. MARSHALL. I take it from what you said a moment ago that y are projecting this work which would make this legislation neces- y the same as your work? In other words, they must be outside 'heir rights in going ahead and diverting water from this navigable e?

Ir. LIPPINCOTT. They propose to make this diversion from the ers without any Federal consent.

Ir. MARSHALL. That is just what I say.

Ir. LIPPINCOTT. We consider that Federal consent is necessary. 'ir declared intention, according to the water notice which they e posted, is to divert more than the entire flow of the Klamath 'er during the summer season, and we consider that it is necessary 'ome before you gentlemen in Congress and get special authority to ke the diversion.

Ir. MARSHALL. You consider that it is necessary for you to do so?

Ir. LIPPINCOTT. Yes, sir.

'he CHAIRMAN. The Klamath River is not navigable in its lower ırse?

Ir. LIPPINCOTT. That is my understanding; it is in a precipitous yon.

'he CHAIRMAN. And there is practically but a small part of the ɔer part of the river that is considered navigable?

Ir. LIPPINCOTT. Yes, sir.

'he CHAIRMAN. Is that used for commercial purposes?

Ir. LIPPINCOTT. There are two gasoline launches, one big enough carry a party of eighteen, which we saw when we went there last vember, and the other smaller, and one flat bottom steam barge ıt is used to transport hay.

Ir. BELL. The Klamath River is navigable between the Upper and wer Klamath lakes?

Ir. LIPPINCOTT. From the foot of the falls.

Mr. BELL. Where it enters the gorge?

Mr. LIPPINCOTT. Yes, sir.

Mr. MARSHALL. But there is no navigation from the lakes to the Klamath River?

Mr. LIPPINCOTT. The Upper Klamath Lake is navigable in the State of Oregon. Then there is a fall of 56 feet that occurs at the outlet.

Mr. BELL. Is that a precipice?

Mr. LIPPINCOTT. It is a cascade.

Mr. BELL. I did not understand that was a fall.

Mr. LIPPINCOTT. Yes, sir. Then, from the foot of the falls, all the rest of this basin region [indicating on map] is navigable.

Mr. BELL. Where is the head of the Klamath Canal Company's works—where do they intend to divert the water?

Mr. LIPPINCOTT. At the outlet of the upper lake.

Mr. BIEN. The Klamath Canal Company's proposed diversion is sufficient to make the Klamath River dry in the summer season and to prevent this interstate navigation.

Mr. MARSHALL. And, therefore, United States legislation is necessary?

Mr. BIEN. Yes, sir.

The CHAIRMAN. Has the Klamath River ever been recognized as a navigable stream, officially?

Mr. LIPPINCOTT. I think to the extent of sending up a boiler inspector last summer.

Mr. MARSHALL. Are there any streams that are meandered?

Mr. LIPPINCOTT. That is more or less a technical question. There are some streams which are navigable technically and not legally.

Mr. BELL. Is it possible for the Klamath Canal Company to divert water for their lands without disturbing the navigability of the lower river?

Mr. LIPPINCOTT. I think not.

Mr. BELL. You think they could not raise the level of Klamath Lake?

Mr. LIPPINCOTT. No, sir.

Mr. GILLETT. How much of the Klamath River do they navigate within the State of California?

Mr. LIPPINCOTT. None of the Klamath River within the State of California except, perhaps, 15 or 20 miles of the Lower Klamath Lake.

Mr. GILLETT. There is an act of the legislature declaring the Klamath River a nonnavigable stream. I think the Klamath River is not a navigable stream. The idea of that was to permit hydraulic mining along the river, and because of the canyons and gorges.

Mr. BIEN. There could be no possibility of navigation below the lakes except near the mouth.

The CHAIRMAN. As a matter of fact, there has been no commercial navigation of any amount on the upper Klamath River?

Mr. LIPPINCOTT. No, sir.

The CHAIRMAN. What is the average rainfall?

Mr. LIPPINCOTT. About 15 inches.

The CHAIRMAN. Is there any farming in the region at all without irrigation?

Mr. LIPPINCOTT. There is the raising of rye and barley, but the growth depends on the character of the rains we have.

The CHAIRMAN. What is the necessity, in your opinion, for legisla-ion to go on with this enterprise other than the problem as to the navi-ability or nonnavigability of this stream?

Mr. LIPPINCOTT. That is all. There is another feature that I have ot yet touched upon.

Mr. BELL. I would like to ask you a question in regard to the navi-ability of this stream. If the navigable portion of this Klamath River ies wholly within the State of Oregon, then it is not an interstate ques-ion, and as far as the navigability of that river is concerned we could ave nothing to do with it?

Mr. LIPPINCOTT. The whole thing is connected by a system of lakes, nd they are really quite extensive lakes.

Mr. BELL. And interference with the river would interfere with the akes?

Mr. LIPPINCOTT. Yes, sir.

Mr. GILLETT. I do not think you have explained to the committee he reservoir site and how it affects Rhett Lake. Rhett Lake is a lake n the boundary line between the two States.

Mr. LIPPINCOTT. I will do so if you desire. Lost River rises largely n this portion of California [indicating on map]. It flows in a very uicuitous way, and then back again into Tule Lake [indicating on map], vhich is cut in two by the State line. Reservoir sites are available at he headwaters of Lost River, and the most of the water of the river ould be stopped in these reservoir sites and used for the irrigation f lands, mostly in Oregon, at an elevation higher than could be com-nanded from the Upper Klamath Lake. In addition to stopping the vater at the reservoir sites, it is possible to turn the water from the ower portion of Lost River into Klamath River. That will cut off he water supply from Tule or Rhett Lake, which is only 12 feet deep, nd with the high rate of evaporation which we have there we think he lake bed will be promptly uncovered.

This Lower Klamath Lake covers 25,000 acres, and has 60,000 acres f marginal swamp land which can only be reclaimed by a very decided owering of the water level, and that can be accomplished very readily, ecause at the outlet of this lower region the river also begins at a ascade and falls very rapidly. So that by going down the river bout a mile and constructing a tunnel, which tunnel will only be ,500 feet long, we can draw down water below the present level of his swamp. That will permit us to drain off all that lower region, nd that act will be the thing that will destroy the navigability of that iver, and it is the thing that we want specific authority to do.

The CHAIRMAN. With reference to the question of navigability you ay there are reasons why you require legislation other than the ques-ion of navigability. What are they?

Mr. LIPPINCOTT. The State of Oregon as well as the State of Cali-ornia might or possibly could claim the beds of those lakes if they vere uncovered, and those two States, through their governors, pro-ose legislation giving those lake beds or any right or title the States ay have to those lake beds back to the United States Government, nd placing them at the disposal of the Secretary of the Interior under he terms of the reclamation act. Now, Mr. Bien tells us that if the tates do give us those lands, the Secretary has not the right to dis-ose of them, that they will not be exactly in the same class as the ublic lands in general, and that the Secretary will have to have

specific authority to subdivide those lands and dispose of them. That is the other point.

Mr. MARSHALL. That is not covered by this bill?

Mr. LIPPINCOTT. No; that is covered by another bill.

Mr. BELL. Where is the other bill that is referred to?

Mr. LIPPINCOTT. Mr. Bard introduced it into the Senate and it was referred to the Committee on Irrigation and Reclamation of Arid Lands.

The CHAIRMAN. If the lakes were drained would the riparian owners have any right in the land so uncovered?

Mr. BIEN. They have some rights, because when the country was first surveyed the lake was very small and shallow and was not navigable in any sense. Since then the lake has filled up and is navigable. We are now investigating very thoroughly that phase of the matter.

The CHAIRMAN. Was the lake meandered originally?

Mr. BIEN. Yes, sir; about 1850, when it was very shallow. We are making surveys and soundings now to find out what the depth was at that time.

The CHAIRMAN. Was it practically the same size as at present?

Mr. BIEN. It was much smaller.

The CHAIRMAN. Then there is a considerable portion of the lake that was originally surveyed?

Mr. BIEN. Yes, sir; and some of it may have been disposed of. We are looking up the records.

The CHAIRMAN. You do not know whether or not the riparian lands up to the old meandered lines were disposed of?

Mr. BIEN. We have not examined all the records, but the point is this, there is a possibility, and I think it is certain, that some rights have vested along the old meander lines which would give those owners some claim to the land under water.

The CHAIRMAN. Have there not been decisions to the effect that in a case of that kind a riparian owner has a claim to the center?

Mr. BIEN. Yes, sir, in case of nonnavigable lakes.

The CHAIRMAN. And the land simply has to be divided among the riparian owners after being drained?

Mr. BIEN. Yes, sir; but only a small portion of the riparian land was ever sold. Then the lakes filled up, and possibly at the time the State was admitted into the Union it may have been navigable, so in that case the title to the land under the water would be in the State; so that there is an important legal question involved. If the matter ever went into court it could never be settled until it went to the Supreme Court of the United States. If we can settle it amicably by the State passing this legislation we should do so.

The CHAIRMAN. The legislation of the States would not in any way affect the rights of the riparian owners?

Mr. BIEN. No, sir; we have discussed the matter with the riparian owners, and the way the situation looks we can make satisfactory arrangements with them.

Mr. UNDERWOOD. What portion of this land is owned by the Government?

Mr. LIPPINCOTT. About half of the land, provided you consider the lake beds.

The CHAIRMAN. Outside of the lake beds the proportion would be much smaller?

Mr. LIPPINCOTT. Yes, sir.

The CHAIRMAN. Comparatively small?

Mr. LIPPINCOTT. Yes, sir; I think between 40,000 and 50,000 acres.

Mr. UNDERWOOD. How much private land is there?

Mr. LIPPINCOTT. The total area that would be reclaimed, including the lake beds, would be 300,000.

The CHAIRMAN. How much land would there be in the lake beds, approximately?

Mr. LIPPINCOTT. Three hundred thousand acres would be reclaimed through the operation—about 180,000 acres of private ownership and, approximately, about 120,000, including the lake beds, of public lands, assuming that the lake beds would be public lands.

Mr. HITCHCOCK. The 300,000 acres being subject to irrigation include the 100,000 acres from the lakes?

Mr. LIPPINCOTT. Yes, sir. Then there are about 90,000 acres in the Indian reservation that I have not included.

Mr. HITCHCOCK. Which would ultimately be reclaimed?

Mr. LIPPINCOTT. Yes, sir; but which we are not talking about now.

Mr. GILLETT. It would be ultimately brought under the general plan?

Mr. LIPPINCOTT. Yes, sir.

Mr. REEDER. If this private project is completed will it irrigate all the land that would be irrigated by the Government if they would install a project?

Mr. LIPPINCOTT. No, sir; I do not think they could possibly irrigate over half or two-thirds, provided they had the financial backing, because of the fact that there are eighty or a hundred thousand acres in the lake beds and about 60,000 acres in the marginal swamps, all of which will have to be reclaimed by destroying this navigation feature.

Mr. REEDER. I understand.

Mr. LIPPINCOTT. We do not think that private parties could do that.

Mr. REEDER. Suppose the navigation feature was destroyed in their favor and they were permitted to go on with their work, could they irrigate all the lands the same as the Government?

Mr. LIPPINCOTT. If we simply got out of the way, I suppose so; yes, sir.

Mr. MARSHALL. They do not propose to store the water on this lake?

Mr. LIPPINCOTT. They could not do that unless we surrendered our rights.

Mr. MARSHALL. They would not if they could.

Mr. LIPPINCOTT. They claim here, just as we hear claimed everywhere in the West, that they intend to do everything that we would do, when, as a matter of fact, we know that it is a serious trouble for them to build a few miles of canal.

Mr. MARSHALL. Even if they did do it, it would not be in the interest of the people in that neighborhood to let them do it?

Mr. LIPPINCOTT. No, sir.

Mr. BELL. What sort of a contract have they made with the settlers? What water rate do they charge the settlers?

Mr. LIPPINCOTT. Their rates for irrigation are $10 an acre and an annual charge of $1.50 an acre. They have seen how public sentiment has grown in favor of the construction of public works and they have lately been making a variety of propositions, one of which is that they

will agree to irrigate the land for $15 an acre and allow the people to pay the $15 in twenty annual installments, and then also make some per annum maintenance charge, which I do not remember.

Mr. BELL. Did you ever look into a question of this kind: If the Government, by its own act or by delegating its power to the department, which would be the same thing practically, actually destroyed the navigation of a stream or lake, are not those waters subject to appropriation under the law of the State or Territory in which they are situated? Have you ever followed up that question?

Mr. BIEN. I know of no such decision.

Mr. BELL. If the Government actually destroys the navigability of a stream, as it would in this case, and it is no longer a navigable stream, can not private parties appropriate the waters of the stream under the laws of the respective States or Territories, irrespective of the Federal Government at all?

Mr. BIEN. I doubt if any such decision has been rendered. I would say if it was actually destroyed, the water would then be subject to appropriation as a nonnavigable stream.

Mr. MARSHALL. Before the Government would destroy it they would take charge of it themselves?

Mr. BIEN. In a case where the Government proposed to destroy the navigation of a stream, and there was any possibility of further appropriation, the Government ought to retain the control of the further appropriation. Of course that would not be necessary in this case, as no water would be available for appropriation when the Government work is completed.

Mr. BELL. Where the Government by an act of legislation or any other act declares that a stream is more valuable for irrigation purposes than it is for commercial purposes, as soon as the legislation is enacted will it not then open the way for private persons to appropriate the water under the State laws in which the streams are situated? I only ask this question for information.

Mr. BIEN. I think it all depends upon the language of the statute. If the statute simply declares that the water is more valuable for irrigation than navigation, it might have that effect; but if the statute is in such form as this bill, authorizing certain work to be done, I think until it is done no other power can intervene and no private parties would have any rights.

Mr. BELL. Do you think the Government can translate its right over a navigable stream for navigable purposes into an irrigation right, and still, as to all the rest of the world and the country, retain the fiction of navigability?

Mr. BIEN. No, sir.

Mr. BELL. The navigability of a stream for interstate commerce is one thing, and the use of a stream for irrigation is another. Do you think the Government can translate that right from commerce into irrigation, and still, as against others, say that there shall be no appropriation of those waters?

Mr. BIEN. I think it is within the power of the Government to do that if it does it specifically; but the point I want to make is this: By authorizing one branch of the Government to destroy navigation, that authorization is evidence in itself that anyone else who desires to do that must get authority from Congress; but when that authority is

once given, and the navigability has been destroyed, it might possibly be that any remaining water could be appropriated.

The CHAIRMAN. I would like to call the attention of the gentleman from California to the fact that Congress has already acted along the lines of his suggestion. Last year the Indian appropriation bill contained a provision to the effect that in undertaking any work under the national reclamation act which the Government might undertake for the irrigation of certain Indian lands the waters of the Colorado River might be diverted. There was a case where Congress assumed authority to allow the diversion of a stream that is in a sense navigable—I suppose would be held by the authorities to be navigable—but in no way did that affect the status of the stream as to its navigability or nonnavigability. Answering the gentleman's question with regard to the effect of legislation declaring a stream nonnavigable, such legislation would only be had ordinarily when navigation was more or less of a fiction and Congress declaring that the stream was not navigable, then the right to divert under State laws would become active.

Mr. BELL. I will say in this connection that I believe in all cases where the reclamation service desires an act of this kind in order to carry on its work we should unhesitatingly grant that power, and I hope in granting these powers we are not going to open up the way for the interference of private speculators who may see opportunities hold up the Government.

Mr. BIEN. The fundamental idea of this whole matter is in the desert-land act of 1877, which provides, after referring to the use of water for entryman, that all surplus water on the public domain not navigable shall be open to appropriation. The insertion of that exception, "not navigable," would cover any case as long as the body of water is navigable.

Mr. HITCHCOCK. Do I understand that this project covering the 300,000 acres will cost $3,000,000?

Mr. LIPPINCOTT. I think it would ultimately, but the project is one which is peculiar in this respect, there are no expensive great works or units to be built at once. We could begin irrigation with a canal a mile long from the upper lake. Then the system can be merely extended as rapidly as the local population and conditions can digest the development, and while the ultimate expenditure would be great it need not be immediate.

Mr. UNDERWOOD. Do they use that land for farming at all?

Mr. LIPPINCOTT. They are using it very largely in connection with the stock business. The people have a small farm which they irrigate and then range the cattle back on the hills. They raise enough feed to keep the cattle during the snow period each year.

Mr. UNDERWOOD. The land embraced in this section is not now farming land?

Mr. LIPPINCOTT. No, sir; it is not extensively or to the best advantage.

Mr. UNDERWOOD. Is it semiarid land?

Mr. LIPPINCOTT. Yes, sir.

The CHAIRMAN. You say there is some farming?

Mr. LIPPINCOTT. Yes, sir.

Mr. UNDERWOOD. How large are the holdings embraced in this area?

Mr. LIPPINCOTT. Nearly all the land has been taken up under the

homestead act, and some of it under the desert act, and already, before we have expressed any particular desire for the people out there to do anything at all, they have signed preliminary contracts to take water, under the terms of the reclamation act, covering over 100,000 acres.

Mr. UNDERWOOD. As to the 180,000 acres of private land, how many people are there on that?

Mr. LIPPINCOTT. I should say that the average farms would be less than 320 and more than 160 acres.

Mr. UNDERWOOD. Any very large holdings of land there?

Mr. LIPPINCOTT. Yes, sir.

Mr. UNDERWOOD. How much do they own?

Mr. LIPPINCOTT. There is one ranch that covers a tract of land along the northeast corner of Rhett Lake; they also own some land around this lake [indicating on map], Clear Lake, and the aggregate holdings of those two ranches is 27,000 or 28,000 acres, and the owners have expressed a desire to cooperate with this work if they can do so by subdividing their ranches and disposing of them.

Mr. UNDERWOOD. Are they willing to reduce their holdings?

Mr. LIPPINCOTT. We have no definite agreement with them, but we have had considerable talk with them, and that particular point is involved in this way: They gave an option on the ranch some time ago, before we made any movement in this section, and the owners of that option practically control the situation, but the actual owners of the ranch are exceedingly anxious to cooperate with us in a reasonable manner.

Mr. REEDER. When does the option expire?

Mr. LIPPINCOTT. The 1st of next June.

Mr. HITCHCOCK. I have not got it clearly in my mind as to what would become of this project of the company which you say has expended $50,000. Will it be wiped out?

Mr. LIPPINCOTT. We propose, so far as we are concerned, to return to the men the amount of money they have actually spent on construction and let them retire from the field uninjured.

Mr. HITCHCOCK. Are they willing to do so?

Mr. LIPPINCOTT. They are now expressing themselves in a manner which would lead us to believe they are.

Mr. UNDERWOOD. Have you the authority under the reclamation act?

Mr. BIEN. The act says that the Secretary may acquire any rights or property necessary for the development of a project. If he finds the purchase is necessary, he has the authority.

Mr. BELL. Are you thoroughly convinced that when we enact a law of this character that we will not entirely validate the prior appropriation made by private persons under a State or Territorial law? That is, they appropriate water, they conform to the laws of the State, and there is just one thing necessary to make their rights complete and that is the consent of the Government. The question of the navigability is the only obstacle. If we, in effect, remove that, will that fully validate and make complete their right under the State? It seems to me that is the most essential thing in this character of legislation; we may be surrendering a very great right which the Government has.

Mr. BIEN. This legislation provides that the Secretary of the Interior may do certain things and have certain powers. That means sim-

ply that the United States proposes to do certain things and I fail to see how any private individual could obtain any rights, because the Government itself proposes to take advantage of a certain situation.

Mr. MARSHALL. In otherwise this bill does not declare the stream navigable, or anything of that kind.

Mr. BIEN. No, sir; and until the navigation is actually destroyed I see no way by which any private parties could gain any rights; and when the navigability of the stream is destroyed by the Government there would not in this case be any water left for other use. Mr. Bell is probably thinking of another situation on the Colorado River.

Mr. BELL. No; I did not know of any.

Mr. BIEN. The Government will use all the water available and will control the situation, and there will be nothing for anybody else to do.

Mr. LIPPINCOTT. The bill that has been introduced in the Oregon legislature gives us specific authority from the State of Oregon to utilize the upper Klamath Lake as a storage reservoir and to lower its level. That lake is wholly within the State of Oregon.

Mr. BELL. Of course that legislation would not affect an appropriation under prior law and the State could not divest its interest.

The CHAIRMAN. It is proper at this time that the committee should decide in a general way as to how extended these hearings are to be and along what lines.

Thereupon, after informal discussion, the committee took a recess until 2 o'clock p. m.

AFTER RECESS.

At the expiration of the recess, at 2 o'clock p. m., the committee resumed its session, Hon. Frank W. Mondell in the chair.

STATEMENT OF F. H. NEWELL, CHIEF ENGINEER RECLAMATION SERVICE, UNITED STATES GEOLOGICAL SURVEY.

Mr. NEWELL. Mr. Chairman and gentlemen, at your request I will endeavor to review, briefly, the reclamation survey and its work, and to bring up to date the discussion which was had before this committee last year. Since that time the work has greatly expanded. We have added a considerable number of men of ability to the reclamation service, and have rapidly pushed construction work in the west. From the standpoint of the man who is not accustomed to such work it might seem that we were going somewhat slowly; but from the standpoint of the engineer, and especially the engineer who has built great works—such as the English and foreign engineers who visited this country last year—we have made rapid progress. In fact, all of those men expressed surprise and astonishment that we should have accomplished so much in such a little time.

In every State and Territory are found complications arising from legal conditions, especially from vested rights, and everywhere cooperation with State officials and individuals is asked and expected.

In every part of the arid region of the United States certain land and water rights have already been acquired, which, if not relinquished, prohibit the construction of reclamation works. Excepting in the cases of Indian reservations which may be opened, and in which is a

of this work as a public enterprise. The people who live there are very anxious for us to proceed, and have so stated their views, and, as I understand it, the Congressional representatives from that section, who of course can speak for themselves, are favorably inclined to it.

Mr. TIRRELL. How much of a population is there now?

Mr. LIPPINCOTT. There is not a very large population. I will say 500 or 600 people were at our meeting at Klamath Falls held to receive Mr. Newell when he arrived there.

Mr. BELL. Where is the nearest railroad to this section?

Mr. LIPPINCOTT. The main line of the Southern Pacific from Sacramento to Portland passes up through Shasta Valley, as indicated by this line [indicating on map]. A branch line runs about 30 miles from the lake region. We have been advised by the railroad companies that as soon as it is determined that we shall build in that region the railroad corporations will all probably construct in there also.

In reference to the private interests in that section we certainly have no desire or inclination to treat one element of the community with more consideration than another, and it is my opinion, so far as that goes, that the gentlemen should be reimbursed for what they have legitimately expended in that section in building canals, and should then be permitted to retire from the field without loss.

Mr. TIRRELL. Can you utilize what they have done in your work?

Mr. LIPPINCOTT. No, sir; as far as the Klamath Canal Company work is concerned.

Mr. TIRRELL. It is practically so much thrown away?

Mr. LIPPINCOTT. Yes, sir.

Mr. BELL. Is the reclamation act broad enough to permit the Secretary of the Interior to acquire their rights and to compensate them for the work done, or will it require additional legislation?

Mr. BIEN. I think the law covers that.

The CHAIRMAN. How much land is there under irrigation by the Ankeny Canal?

Mr. LIPPINCOTT. Five thousand acres.

The CHAIRMAN. How long has the canal been constructed?

Mr. LIPPINCOTT. Fifteen years.

The CHAIRMAN. How much land could be irrigated under it?

Mr. LIPPINCOTT. We could use the Ankeny and extend it so as to irrigate a great deal more.

The CHAIRMAN. Is practically all the land now under the Ankeny Canal under irrigation?

Mr. LIPPINCOTT. No, sir. This canal is not a very large canal and it is irrigating all the land that it can serve.

The CHAIRMAN. By reason of the capacity of the canal?

Mr. LIPPINCOTT. Yes, sir.

Mr. TIRRELL. Are these corporations or individuals who own the canals?

Mr. LIPPINCOTT. Corporations.

Mr. HITCHCOCK. Is there any local opposition to the movement of which this bill is a part?

Mr. LIPPINCOTT. So far as the people who are land owners in that section are concerned, the community at large, there is no difference of opinion. The Klamath Canal Company, which is the only opposition to this movement in that section, might possibly object to the bill, but their diversion of water from that lake is precisely the same thing that we propose to do and which we consider necessitates this bill.

liamson, I suggest that he take up certain important matters as
ı as we go over these generalities.
[r. Quinton, one of the consulting engineers, was here this morning,
Mr. W. H. Saunders, another of the consulting engineers for Col-
lo, Nebraska, New Mexico, Oklahoma, and Utah, is here with us
ay.
hese last two gentlemen may be considered representatives of the
y of consulting engineers—men whose business it is to meet and
sider the different projects, discuss them from the engineering
ıdpoint, and devote their time exclusively to them without the
ession necessary in connection with executive work, such as must
arried on by the supervising and district engineers. It has been
nd necessary to have a body of men who can assemble at different
ıts and take up the various problems, pass upon them, and make
nite recommendations for action regarding each of the great
jects.
here are here, in addition, certain experts.
[r. O. H. Ensign, electrical expert for the Pacific coast, is here.
s his business to give special attention to the construction of power
ıts and mechanical devices for raising water. In many of these
e enterprises it will be necessary to pump water, either by elec-
al power developed by stored water or by burning fuel—such as
ites, oils, or ordinary coal.
[r. H. A. Storrs, another of the electrical experts, is here in the
. He is looking after similar problems in the Rocky Mountain
ion.
hese are representative of the body of men who are what might be
ned consulting engineers on specific lines of work, and who devote
r time exclusively to the mechanical problems of controlling and
ing water.
nother class of men is represented by Mr. Morris Bien, who ranks
upervising engineer, and has charge of the legal questions. There
a great number of such questions presented, pertaining both to
e and to national law, rights of way, and proposed legislation. Mr.
n and his assistants are fully occupied with matters of purchases
and, extinguishment of titles, suggestions to State officials and leg-
tures regarding new laws, and so on. I may say here that the
es of Oregon and Washington, in particular, have appointed com-
sions which have met, and have asked Mr. Bien to draft certain
es which are now under consideration by both legislatures.
[r. TIRRELL. Is Mr. Bien a lawyer?
[r. NEWELL. Yes; he was educated primarily as an engineer; is a
fornian, a graduate of the Univerisity of the State of California.
several years he was a topographer of the U. S. Geological Sur-
. Later he was engaged in the right-of-way work of the General
d Office, after having many years' service in the field as a practi-
surveyor and engineer. He is a graduate of a law school, having
n a post-graduate course here in Washington, and has been admit-
to the bar.
[r. TIRRELL. The reason I asked is that we have here a bill which
lves questions of law. And I wanted to know whether those mat-
were inserted at his option or originated with him, or whether you
sulted with the law department here in connection with them.

Mr. BELL. Where it enters the gorge?

Mr. LIPPINCOTT. Yes, sir.

Mr. MARSHALL. But there is no navigation from the lakes to the Klamath River?

Mr. LIPPINCOTT. The Upper Klamath Lake is navigable in the State of Oregon. Then there is a fall of 56 feet that occurs at the outlet.

Mr. BELL. Is that a precipice?

Mr. LIPPINCOTT. It is a cascade.

Mr. BELL. I did not understand that was a fall.

Mr. LIPPINCOTT. Yes, sir. Then, from the foot of the falls, all the rest of this basin region [indicating on map] is navigable.

Mr. BELL. Where is the head of the Klamath Canal Company's works—where do they intend to divert the water?

Mr. LIPPINCOTT. At the outlet of the upper lake.

Mr. BIEN. The Klamath Canal Company's proposed diversion is sufficient to make the Klamath River dry in the summer season and to prevent this interstate navigation.

Mr. MARSHALL. And, therefore, United States legislation is necessary?

Mr. BIEN. Yes, sir.

The CHAIRMAN. Has the Klamath River ever been recognized as a navigable stream, officially?

Mr. LIPPINCOTT. I think to the extent of sending up a boiler inspector last summer.

Mr. MARSHALL. Are there any streams that are meandered?

Mr. LIPPINCOTT. That is more or less a technical question. There are some streams which are navigable technically and not legally.

Mr. BELL. Is it possible for the Klamath Canal Company to divert water for their lands without disturbing the navigability of the lower river?

Mr. LIPPINCOTT. I think not.

Mr. BELL. You think they could not raise the level of Klamath Lake?

Mr. LIPPINCOTT. No, sir.

Mr. GILLETT. How much of the Klamath River do they navigate within the State of California?

Mr. LIPPINCOTT. None of the Klamath River within the State of California except, perhaps, 15 or 20 miles of the Lower Klamath Lake.

Mr. GILLETT. There is an act of the legislature declaring the Klamath River a nonnavigable stream. I think the Klamath River is not a navigable stream. The idea of that was to permit hydraulic mining along the river, and because of the canyons and gorges.

Mr. BIEN. There could be no possibility of navigation below the lakes except near the mouth.

The CHAIRMAN. As a matter of fact, there has been no commercial navigation of any amount on the upper Klamath River?

Mr. LIPPINCOTT. No, sir.

The CHAIRMAN. What is the average rainfall?

Mr. LIPPINCOTT. About 15 inches.

The CHAIRMAN. Is there any farming in the region at all without irrigation?

Mr. LIPPINCOTT. There is the raising of rye and barley, but the growth depends on the character of the rains we have.

The CHAIRMAN. What is the necessity, in your opinion, for legislation to go on with this enterprise other than the problem as to the navigability or nonnavigability of this stream?

Mr. LIPPINCOTT. That is all. There is another feature that I have not yet touched upon.

Mr. BELL. I would like to ask you a question in regard to the navigability of this stream. If the navigable portion of this Klamath River lies wholly within the State of Oregon, then it is not an interstate question, and as far as the navigability of that river is concerned we could have nothing to do with it?

Mr. LIPPINCOTT. The whole thing is connected by a system of lakes, and they are really quite extensive lakes.

Mr. BELL. And interference with the river would interfere with the lakes?

Mr. LIPPINCOTT. Yes, sir.

Mr. GILLETT. I do not think you have explained to the committee the reservoir site and how it affects Rhett Lake. Rhett Lake is a lake on the boundary line between the two States.

Mr. LIPPINCOTT. I will do so if you desire. Lost River rises largely in this portion of California [indicating on map]. It flows in a very cuicuitous way, and then back again into Tule Lake [indicating on map], which is cut in two by the State line. Reservoir sites are available at the headwaters of Lost River, and the most of the water of the river could be stopped in these reservoir sites and used for the irrigation of lands, mostly in Oregon, at an elevation higher than could be commanded from the Upper Klamath Lake. In addition to stopping the water at the reservoir sites, it is possible to turn the water from the lower portion of Lost River into Klamath River. That will cut off the water supply from Tule or Rhett Lake, which is only 12 feet deep, and with the high rate of evaporation which we have there we think the lake bed will be promptly uncovered.

This Lower Klamath Lake covers 25,000 acres, and has 60,000 acres of marginal swamp land which can only be reclaimed by a very decided lowering of the water level, and that can be accomplished very readily, because at the outlet of this lower region the river also begins at a cascade and falls very rapidly. So that by going down the river about a mile and constructing a tunnel, which tunnel will only be 1,500 feet long, we can draw down water below the present level of this swamp. That will permit us to drain off all that lower region, and that act will be the thing that will destroy the navigability of that river, and it is the thing that we want specific authority to do.

The CHAIRMAN. With reference to the question of navigability you say there are reasons why you require legislation other than the question of navigability. What are they?

Mr. LIPPINCOTT. The State of Oregon as well as the State of California might or possibly could claim the beds of those lakes if they were uncovered, and those two States, through their governors, propose legislation giving those lake beds or any right or title the States may have to those lake beds back to the United States Government, and placing them at the disposal of the Secretary of the Interior under the terms of the reclamation act. Now, Mr. Bien tells us that if the States do give us those lands, the Secretary has not the right to dispose of them, that they will not be exactly in the same class as the public lands in general, and that the Secretary will have to have

specific authority to subdivide those lands and dispose of them. That is the other point.

Mr. MARSHALL. That is not covered by this bill?

Mr. LIPPINCOTT. No; that is covered by another bill.

Mr. BELL. Where is the other bill that is referred to?

Mr. LIPPINCOTT. Mr. Bard introduced it into the Senate and it was referred to the Committee on Irrigation and Reclamation of Arid Lands.

The CHAIRMAN. If the lakes were drained would the riparian owners have any right in the land so uncovered?

Mr. BIEN. They have some rights, because when the country was first surveyed the lake was very small and shallow and was not navigable in any sense. Since then the lake has filled up and is navigable. We are now investigating very thoroughly that phase of the matter.

The CHAIRMAN. Was the lake meandered originally?

Mr. BIEN. Yes, sir; about 1850, when it was very shallow. We are making surveys and soundings now to find out what the depth was at that time.

The CHAIRMAN. Was it practically the same size as at present?

Mr. BIEN. It was much smaller.

The CHAIRMAN. Then there is a considerable portion of the lake that was originally surveyed?

Mr. BIEN. Yes, sir; and some of it may have been disposed of. We are looking up the records.

The CHAIRMAN. You do not know whether or not the riparian lands up to the old meandered lines were disposed of?

Mr. BIEN. We have not examined all the records, but the point is this, there is a possibility, and I think it is certain, that some rights have vested along the old meander lines which would give those owners some claim to the land under water.

The CHAIRMAN. Have there not been decisions to the effect that in a case of that kind a riparian owner has a claim to the center?

Mr. BIEN. Yes, sir, in case of nonnavigable lakes.

The CHAIRMAN. And the land simply has to be divided among the riparian owners after being drained?

Mr. BIEN. Yes, sir; but only a small portion of the riparian land was ever sold. Then the lakes filled up, and possibly at the time the State was admitted into the Union it may have been navigable, so in that case the title to the land under the water would be in the State; so that there is an important legal question involved. If the matter ever went into court it could never be settled until it went to the Supreme Court of the United States. If we can settle it amicably by the State passing this legislation we should do so.

The CHAIRMAN. The legislation of the States would not in any way affect the rights of the riparian owners?

Mr. BIEN. No, sir; we have discussed the matter with the riparian owners, and the way the situation looks we can make satisfactory arrangements with them.

Mr. UNDERWOOD. What portion of this land is owned by the Government?

Mr. LIPPINCOTT. About half of the land, provided you consider the lake beds.

The CHAIRMAN. Outside of the lake beds the proportion would be much smaller?

Mr. LIPPINCOTT. Yes, sir.

The CHAIRMAN. Comparatively small?

Mr. LIPPINCOTT. Yes, sir; I think between 40,000 and 50,000 acres.

Mr. UNDERWOOD. How much private land is there?

Mr. LIPPINCOTT. The total area that would be reclaimed, including the lake beds, would be 300,000.

The CHAIRMAN. How much land would there be in the lake beds, approximately?

Mr. LIPPINCOTT. Three hundred thousand acres would be reclaimed through the operation—about 180,000 acres of private ownership and, approximately, about 120,000, including the lake beds, of public lands, assuming that the lake beds would be public lands.

Mr. HITCHCOCK. The 300,000 acres being subject to irrigation include the 100,000 acres from the lakes?

Mr. LIPPINCOTT. Yes, sir. Then there are about 90,000 acres in the Indian reservation that I have not included.

Mr. HITCHCOCK. Which would ultimately be reclaimed?

Mr. LIPPINCOTT. Yes, sir; but which we are not talking about now.

Mr. GILLETT. It would be ultimately brought under the general plan?

Mr. LIPPINCOTT. Yes, sir.

Mr. REEDER. If this private project is completed will it irrigate all the land that would be irrigated by the Government if they would install a project?

Mr. LIPPINCOTT. No, sir; I do not think they could possibly irrigate over half or two-thirds, provided they had the financial backing, because of the fact that there are eighty or a hundred thousand acres in the lake beds and about 60,000 acres in the marginal swamps, all of which will have to be reclaimed by destroying this navigation feature.

Mr. REEDER. I understand.

Mr. LIPPINCOTT. We do not think that private parties could do that.

Mr. REEDER. Suppose the navigation feature was destroyed in their favor and they were permitted to go on with their work, could they irrigate all the lands the same as the Government?

Mr. LIPPINCOTT. If we simply got out of the way, I suppose so; yes, sir.

Mr. MARSHALL. They do not propose to store the water on this lake?

Mr. LIPPINCOTT. They could not do that unless we surrendered our rights.

Mr. MARSHALL. They would not if they could.

Mr. LIPPINCOTT. They claim here, just as we hear claimed everywhere in the West, that they intend to do everything that we would do, when, as a matter of fact, we know that it is a serious trouble for them to build a few miles of canal.

Mr. MARSHALL. Even if they did do it, it would not be in the interest of the people in that neighborhood to let them do it?

Mr. LIPPINCOTT. No, sir.

Mr. BELL. What sort of a contract have they made with the settlers? What water rate do they charge the settlers?

Mr. LIPPINCOTT. Their rates for irrigation are $10 an acre and an annual charge of $1.50 an acre. They have seen how public sentiment has grown in favor of the construction of public works and they have lately been making a variety of propositions, one of which is that they

will agree to irrigate the land for $15 an acre and allow the people to pay the $15 in twenty annual installments, and then also make some per annum maintenance charge, which I do not remember.

Mr. BELL. Did you ever look into a question of this kind: If the Government, by its own act or by delegating its power to the department, which would be the same thing practically, actually destroyed the navigation of a stream or lake, are not those waters subject to appropriation under the law of the State or Territory in which they are situated? Have you ever followed up that question?

Mr. BIEN. I know of no such decision.

Mr. BELL. If the Government actually destroys the navigability of a stream, as it would in this case, and it is no longer a navigable stream, can not private parties appropriate the waters of the stream under the laws of the respective States or Territories, irrespective of the Federal Government at all?

Mr. BIEN. I doubt if any such decision has been rendered. I would say if it was actually destroyed, the water would then be subject to appropriation as a nonnavigable stream.

Mr. MARSHALL. Before the Government would destroy it they would take charge of it themselves?

Mr. BIEN. In a case where the Government proposed to destroy the navigation of a stream, and there was any possibility of further appropriation, the Government ought to retain the control of the further appropriation. Of course that would not be necessary in this case, as no water would be available for appropriation when the Government work is completed.

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Mr. BIEN. No, sir.

Mr. BELL. The navigability of a stream for interstate commerce is one thing, and the use of a stream for irrigation is another. Do you think the Government can translate that right from commerce into irrigation, and still, as against others, say that there shall be no appropriation of those waters?

Mr. BIEN. I think it is within the power of the Government to do that if it does it specifically; but the point I want to make is this: By authorizing one branch of the Government to destroy navigation, that authorization is evidence in itself that anyone else who desires to do that must get authority from Congress; but when that authority is

once given, and the navigability has been destroyed, it might possibly be that any remaining water could be appropriated.

The CHAIRMAN. I would like to call the attention of the gentleman from California to the fact that Congress has already acted along the lines of his suggestion. Last year the Indian appropriation bill contained a provision to the effect that in undertaking any work under the national reclamation act which the Government might undertake for the irrigation of certain Indian lands the waters of the Colorado River might be diverted. There was a case where Congress assumed authority to allow the diversion of a stream that is in a sense navigable—I suppose would be held by the authorities to be navigable—but in no way did that affect the status of the stream as to its navigability or nonnavigability. Answering the gentleman's question with regard to the effect of legislation declaring a stream nonnavigable, such legislation would only be had ordinarily when navigation was more or less of a fiction and Congress declaring that the stream was not navigable, then the right to divert under State laws would become active.

Mr. BELL. I will say in this connection that I believe in all cases where the reclamation service desires an act of this kind in order to carry on its work we should unhesitatingly grant that power, and I hope in granting these powers we are not going to open up the way for the interference of private speculators who may see opportunities hold up the Government.

Mr. BIEN. The fundamental idea of this whole matter is in the desert-land act of 1877, which provides, after referring to the use of water for entryman, that all surplus water on the public domain not navigable shall be open to appropriation. The insertion of that exception, "not navigable," would cover any case as long as the body of water is navigable.

Mr. HITCHCOCK. Do I understand that this project covering the 300,000 acres will cost $3,000,000?

Mr. LIPPINCOTT. I think it would ultimately, but the project is one which is peculiar in this respect, there are no expensive great works or units to be built at once. We could begin irrigation with a canal a mile long from the upper lake. Then the system can be merely extended as rapidly as the local population and conditions can digest the development, and while the ultimate expenditure would be great it need not be immediate.

Mr. UNDERWOOD. Do they use that land for farming at all?

Mr. LIPPINCOTT. They are using it very largely in connection with the stock business. The people have a small farm which they irrigate and then range the cattle back on the hills. They raise enough feed to keep the cattle during the snow period each year.

Mr. UNDERWOOD. The land embraced in this section is not now farming land?

Mr. LIPPINCOTT. No, sir; it is not extensively or to the best advantage.

Mr. UNDERWOOD. Is it semiarid land?

Mr. LIPPINCOTT. Yes, sir.

The CHAIRMAN. You say there is some farming?

Mr. LIPPINCOTT. Yes, sir.

Mr. UNDERWOOD. How large are the holdings embraced in this area?

Mr. LIPPINCOTT. Nearly all the land has been taken up under the

Globe, Ariz., at $4.80 per barrel. Informal proposals having been received for furnishing the cement at less cost than the above, the bid was rejected and purchase made in open market.

January 15, 1904, proposals were invited, by advertisement, for 150,000 barrels of Portland cement, delivered at Salt River dam site, Arizona. Three bids were received, $5.70, $5.49, and $4.81 per barrel, respectively. Upon investigation the board of engineers designated to consider the matter found that first-class Portland cement can be made on the ground at a cost of less than $3 per barrel, including entire cost of plant, fuel, etc., and recommended rejection of the proposals. The proposals were rejected on March 4, 1904, and steps taken at once for the erection of a cement mill at the dam site and the manufacture of the material by the United States.

PURCHASES OF CEMENT.

Bids for furnishing 1,000 barrels of cement were opened in the city of Washington and rejected. The lowest bid was $6 per barrel at Globe.

Bids for furnishing 200,000 barrels of cement were opened on January 29, 1904, and rejected. The lowest bid, $4.81.

Bids for building a cement mill complete were opened September 22, 1903, and the contract was signed March 5, 1904.

This delay made it impossible to use, in most of the structures along the power canal, cement manufactured by the mill.

One thousand barrels of cement were purchased in the open market at $2.62, delivered at Globe. This charge was made up of two parts: Cement at $1.10 per barrel at the mill at Portland; freight at $1.52 per barrel from Portland to Globe.

After bids for 200,000 barrels were rejected, the railroad companies refused to honor this rate, but were finally persuaded to do so for the first 1,000 barrels. After this the best rate we were able to get was $2.66 per barrel for freight, the price of the cement at the mill remaining the same.

The price at the mill, of cement purchased in open market, is at a rate per barrel less than the company offered to furnish it under a contract for 200,000 barrels.

The present price of $3.76 at Globe is less by more than 30 per cent than the price obtainable from any other company.

Authority to purchase 15,000 barrels of cement has been obtained, but no cement has as yet been purchased under the last authorization for the purchase of 5,000 barrels. If the mill can furnish it in time no further orders will be necessary, but in case of an unusual demand this month by the contractors it may be necessary to purchase more immediately in order not to subject them to delay.

CEMENT PURCHASED.

Arizona.—Salt River project:

Authority No. 1112, March 3, 1904, 1 carload, $2.62 per barrel.
Authority No. 1140, March 29, 1904, 1,000 barrels, $2.62 per barrel.
April 23, 1904, 1,000 barrels, $3.76 per barrel.
Authority No. 86, April 26, 1904, 5,000 barrels, $3.76 per barrel.
Field, November 28, 1904, 5,000 barrels, $3.76 per barrel.

Nevada.—Truckee-Carson project:

Authority dated February 6, 1904, to purchase in open market under exigency clause after rejection of bids. Contract was made for 40,000 barrels.

I want to call your attention to the fact that in each case we have not touched, and do not propose to touch, what is called the major portion of the fund for any one State—that is to say, for Oklahoma we have set aside the major portion, 51 per cent, of the funds arising from Oklahoma, although we have not yet discovered a feasible project for that Territory. In no case will we touch the fund which the law says should be allotted to each State as far as feasible, the 51 per cent being taken arbitrarily as the major portion, but the minor portion has been assigned to the localities where, from all appearances, we believe the best results can be obtained for a given expenditure.

Mr. BELL. Does your report show the proceeds of the sales of public lands in each of the States and the relation that that bears to the amount that is allotted?

Mr. NEWELL. Yes; that is very carefully digested in that report. I suggest, Mr. Chairman, that Mr. Savage speak, and then Mr. Ross, and then Mr. McConnell, if it meets with your approval.

The CHAIRMAN. That is entirely satisfactory to us. The committee expect that the gentlemen will take up these matters in the order in which you prefer to have them taken up.

STATEMENT OF H. N. SAVAGE, SUPERVISING ENGINEER FOR THE NORTHWEST.

Mr. SAVAGE. Gentlemen, before taking up the subject referred to by Mr. Williamson this morning, I would like to make a brief general statement regarding the investigations that have been made, and some of the problems arising in the development of projects up to the point of construction.

Practically every irrigation project in the United States has already been investigated—sometimes several times—by private interests, and a great many rights have been acquired. In our work we find it necessary, therefore, to enter into negotiations and acquire, either by purchase or othewise, some parts of nearly all of our projects.

In the matter of lands that was brought up this morning, while there is some inquiry as to the desirability of taking up a project that includes private lands, as against devoting our attention to public lands, the operation of the reclamation service under its present policy makes it practically immaterial, whether the land is now public domain or in private ownership. That is because of our policy of requiring the owners of all these private lands to subdivide them into the same areas that are provided for by the act, and to dispose of them to actual home settlers, who have to be bona fide settlers, the same on the private lands as on the public domain. While we would like to find projects free from these complications, they do not exist; so we have to meet them.

In the projects that are developed up to the point of construction, we have been able to reach an agreement with the owners or claimants of these rights, and have gotten them in shape so that we can take possession and go ahead.

By way of showing the classes of these things in the Wyoming situation, where we are now ready to advertise for bids, out of that tract there was 60,000 acres which had been withdrawn as a Geary segregation, under the leadership of Colonel Cody, and the people were expecting to go ahead, in good faith, with the construction. We investigate all of these projects, all of the factors controlling them or in any way connected with them, develop them up to a point where we can decide what can properly be done with them, and then we go before the people—the people of the whole United States. We like to have them know all the details as far as they can, the State officials and the Government officials, realizing that our support in every way must come from the full accord of the entire public. In the Cody project, after careful consideration and discussion, Colonel Cody, who was the principal operator, saw fit to turn over his entire private project to the Government, which was done by the cooperation of the State.

In the project in the southern portion of Wyoming we had two quite important negotiations. The first one, that has now been concluded,

would have prevented the construction of that project. That has been gotten out of the way. We also have another one under negotiation now with a man by the name of Leavitt, who has told us within the last few days that he was going to conduct an aggressive campaign here regarding his private interests.

I mention these things that you may realize something about the reason for the matter that Mr. Williamson has in mind. That refers particularly to the Malheur project in extreme eastern Oregon. Ninety thousand acres of land can be irrigated from the flood flow of the Malheur River, all of which will have to be stored in a reservoir, a very good site for one having been found. Of the land concerned, something over one-third is now in private ownership, about one-third is unpatented Government land, and the balance is in the hands of the owners of military road-grant lands, which were donated, as you know, about the same time and under approximately the same general conditions that the railroad-grant lands were.

This investigation has been taken up and carried on with the entire support and cooperation of the representative of the owners of these road-grant lands; and he has appeared before our committee or before the Water Users' Association several times, and assured us of his belief that it was the best thing that could happen to the interests of his principals; that they were in every way interested, and that he would undertake to bring about an arrangement whereby this project could be carried out.

These lands are owned in each alternate section, scattered through the entire tract. A somewhat complete drainage system will have to be put in for all of the lands, and without the addition of these lands the project will not be feasible.

We have the surveys all complete; the estimates are in the main complete; a Water Users' Association has been formed, and those people are now in shape to complete their organization up to the point of contracting with the honorable Secretary for the construction of the project.

I received yesterday morning a message from the principal representative of the road-grant lands, saying that the owners, after consideration, do not favor the arrangement, although they fully recognize the many advantages that would accrue from the development of this project; and furthermore saying that the details are in the hands of their Pacific coast representatives—one of which representatives, as I have heretofore stated, is enthusiastically in favor of the project. These same people at this time are developing or cooperating in the development of another project that I know of, in the central part of the State.

Now, the policy of our reclamation service is not to force anybody to do anything. At the same time we develop these various sites, bring them up to the point I have named, and submit them to the people, the State officials, the Government officials. One of the Senators from Oregon has just introduced a bill providing for the condemnation by the Secretary of the Interior of lands which are irrigable, under our project, and also further providing for the disposition of those lands in accordance with the provisions of the reclamation act.

If it be the desire and the will of the majority of the people interested in that State that that project be carried on, we should be very

glad to have that authority specifically granted to the Secretary; and after all of the other resources are exhausted, if it is then thought wise to take advantage of the provisions of that act we would be enabled to carry on that project.

In the handling of railroad lands (of which, of course, there are many throughout there) we have so far had extremely pleasant relations with the railroads in our consideration of the handling of their lands. So far it has been the policy to bring about an arrangement whereby the railroad companies owning these lands would have them classified, the same as unpatented Government land, and dispose of them under conditions developed by the reclamation service, and practically under the terms that the reclamation service would dictate as being proper. In fact, the representatives of several of these roads have assured us that they will dispose of their lands under such general conditions as seem in the broadest way best to bring about the development of the greatest number of homes throughout the region in which they own lands.

With that general statement leading up to Mr. Williamson's inquiry, I shall be pleased to answer any questions regarding any of these other projects that the chief engineer has referred to as being specially under my supervision.

The CHAIRMAN. Is the California-Oregon project that has been under discussion within the limits of the railroad land grants? You spoke of railroad lands; were you discussing them particularly?

Mr. SAVAGE. I was not discussing that particular project at that time. I had in mind one of the projects in Washington, and one in the extreme eastern portion of Montana, and also others along the Union Pacific Railway.

Mr. WILLIAMSON. Mr. Savage gave the committee a suggestion to the effect that there was a bill over in the Senate which will soon arrive here which will embody that principle. If I understand, that is a copy of the bill which is now pending before the Senate committee, and will be over here before this committee in a few days.

Mr. SAVAGE. We have complete reports on that situation, and plats showing the lands; and we will be glad to give you at any time any detailed information that will enable you to get any understanding that you may desire as to the exact conditions.

The CHAIRMAN. What lands or what project was it particularly intended to aid by the passage of this bill? What was particularly in mind?

Mr. SAVAGE. Any project under consideration where there is some small interest that will prevent the development of a large irrigation project because of the disinclination of the owners to cooperate or enter into negotiations that will make such development and construction possible.

Mr. WILLIAMSON. Mr. Savage, perhaps just a question will clear up that matter in the chairman's mind. Take this Malheur proposition; this military wagon-road grant, comprising one-third of the 90,000 acres that are irrigable in that locality, would hold up or destroy the possibility of irrigating the balance of that land; and this bill has in view some arrangement being made by the Government with the owners of that land to clear away those rights, so that it can be taken and the balance of the land can be irrigated.

The CHAIRMAN. This bill would give the reclamation service authority to condemn very large or small bodies of land for the purpose of irrigating.

Mr. WILLIAMSON. I have not looked over the bill; I suppose so.

Mr. SAVAGE. That is its intent, as I read it. It is generally understood, I believe, that the reclamation act gives authority for the acquisition of rights of way in general; but I understand that it does not give, according to the general opinion, the specific right to condemn any lands of any magnitude that might be necessary to make feasible the construction of any specific project. It is not the intent to utilize any such right if it be given, unless it is a matter of public policy of the broadest kind.

Mr. BELL. That bill does not include railroad lands, does it?

Mr. SAVAGE. I think it would include railroad lands.

Mr. MARSHALL. It covers everything; it is just a general, broad proposition.

Mr. TIRRELL. Do these men hold out for a bigger price, claiming that if they fall in with your scheme they will not get so much for their interests, or is it because they honestly think they can develop the property themselves?

Mr. SAVAGE. These people, as I understand, own between 800,000 and 900,000 acres of land in the State of Oregon.

The CHAIRMAN. Which particular tract have you in mind?

Mr. SAVAGE. The Malheur irrigation project, in the extreme eastern portion of Oregon, on the Malheur River. They have expressed a desire to sell those lands in a body. They have three representatives in the United States—one in New York, one in San Francisco, and one in Portland, Oreg. The gentleman in Portland, Oreg., has been in constant communication with us, has visited the land, and has declared himself (and, as far as he could speak for them, his principals) to be heartily in favor of such an arrangement. I understand that the representative from California—in fact, he told me so—was not particularly enthusiastic about this, but thought it might be a good idea and would investigate it. I understand from those two that the representative in New York, who knows less about it, is opposed to any arrangement whatever, it being given me to understand that there might be some question whether they would receive the value that they would like to get from those lands under such an arrangement as would have to be brought about if they were irrigated under the reclamation act, and, rather than take the responsibility of advising their principals here, they will simply do nothing about it.

Mr. MARSHALL. Right there, Mr. Savage, you spoke of this arrangement: I take it that the arrangement would be that a price would be agreed on for this land, and that they would have to take their payments in installments the same as in the case of the Government land—or what is the plan?

Mr. SAVAGE. In dealing with private lands the policy of the reclamation service has been to require their subdivision into areas not to exceed 160 acres.

Mr. MARSHALL. That is what I understand.

Mr. SAVAGE. And then to require that they be put into the hands of bona fide home settlers. The private landowners are at liberty to sell their lands at any price they can realize up to the time the irrigation project is completed and ready to distribute water. At that time

they must be in the hands of individual owners; and a trust deed has been required from each of these owners of areas larger than 160 acres, under the conditions of which they have obligated themselves to so dispose of their lands.

Mr. MARSHALL. At whatever price they can get?

Mr. SAVAGE. At whatever price they can get, the idea being to bring about simply the enforced opening up of those lands for individual homes. They make their own terms.

The CHAIRMAN. You refer to seven or eight thousand acres being held in one body under what you call the Malheur project. The project contemplated there by the reclamation service would include a considerable amount of public land in addition to this land, would it?

Mr. SAVAGE. The Malheur project contemplates the irrigation at this time of about 90,000 acres, of which, in round numbers, one-third is unpatented public land, one-third in the hands of local private landowners, and about one-third in the hands of this Paris syndicate that own a total of 800,000 acres in the State of Oregon.

The CHAIRMAN. They do not own anything like that amount of land in that region.

Mr. SAVAGE. No; they own between 25,000 and 30,000 acres that could be irrigated by this project; but it is scattered through it in each alternate section. They were military road grant lands, which are very similar in character and condition to railroad lands.

The CHAIRMAN. About a third of the land in the Malheur project, then, is public land?

Mr. SAVAGE. Yes, sir.

Mr. MARSHALL. But, mind you, the third that belongs to this military land grant is scattered in alternate sections throughout the tract, and it would be impossible to do anything without it.

The CHAIRMAN. Do these people object to entering into an agreement with the Government on the general terms of the reclamation act?

Mr. WILLIAMSON. Yes; they object.

The CHAIRMAN. Have they objected, in other words, to the cutting up of their lands into 160-acre tracts, and the sale of them?

Mr. SAVAGE. I understand from the Pacific coast representatives that the gentleman in New York, the third representative, has advised his principals that it will not be a wise arrangement for them to bring about the irrigation of their lands in accordance with the reclamation act.

The CHAIRMAN. You do not know certainly, however, that it would be necessary to invoke the provisions of a bill of this sort in that case?

Mr. SAVAGE. I know that without something of that kind it will not be possible to bring about any development of that Malheur irrigation project at this time.

The CHAIRMAN. But it will be possible to do it if these people will agree to the terms of the reclamation act, will it not? In other words, it is not necessary to condemn if they are willing to come in?

Mr. MARSHALL. It is not the idea to condemn except as a matter of last resort.

The CHAIRMAN. So I understand.

Mr. SAVAGE. Answering your question, Mr. Chairman, I have personally seen the two Pacific coast representatives, who have been working on this matter for about six months. They have told me that

they would have the matter in shape so that they could come down here at this time if there was any possibility of their taking it up and concluding the negotiations with us. Since coming here I have received a letter from the gentleman in Portland, in which he says that he understands it will not be opened up again, and I have a response to my inquiry from the gentleman in New York in which he says that my visit will be purposeless.

The CHAIRMAN. You assume, then, from the information which you have that they will not agree to the terms of the reclamation act, and the only way to get their lands would be to condemn them?

Mr. SAVAGE. I do not assume that; I have the positive statement of the gentleman in Portland that his principals have refused to consider it, and I have taken it up again and gotten it up this far toward a reconsideration, which the American representatives refuse to take to Paris.

The CHAIRMAN. Have they any plan whereby they propose to irrigate their lands?

Mr. SAVAGE. They have not.

The CHAIRMAN. What possible use can they put their lands to, then, that will bring them any considerable income, unless they are irrigated?

Mr. SAVAGE. I know of none. I know there is none.

The CHAIRMAN. Then, as a matter of fact, they are simply standing out for better terms?

Mr. SAVAGE. I think they are standing out because of a disinclination to make the effort and devote the time necessary to bring about the settlement of that part of the country according to the reclamation act.

The CHAIRMAN. Could the Malheur project be carried out—would it be possible without the irrigation of this land?

Mr. SAVAGE. It will not be possible, and will not be carried out by the reclamation service.

Mr. MARSHALL. Are they offering these lands for sale at all?

Mr. SAVAGE. They have not been offering them for sale, and have not been selling them in any quantity. An occasional quarter-section has been sold, after a great deal of pressure has been brought to bear by the people who have some of the ditches at the present time.

Now, gentlemen, we do not ask, from the reclamation standpoint, any authority to do any of this work except it have the thorough approval of the authorities of the United States and the State and all the people interested; but we have a number of projects under consideration where, unless we have some authority that the Secretary may condemn small tracts, they can not be declared feasible.

Mr. MARSHALL. To go back to this proposition and follow it out, now, you require a trust deed?

Mr. SAVAGE. Yes, sir.

Mr. MARSHALL. In the event that they fail to "get a move on them" and dispose of these lands, does the Department go on? Is it the intention of the Department then——

Mr. SAVAGE. The Secretary, as we understand, is the trustee for these funds?

Mr. MARSHALL. Yes.

Mr. SAVAGE. He invests them so that the investment will pay a return; and he simply requires that these lands be in the hands of set-

tlers who can begin to pay back to that fund their pro rata per year, whenever the system is constructed.

Mr. MARSHALL. I understand. But suppose these people give this trust deed which you require, and suppose then they fail to sell them—I simply want to follow it out to its conclusion.

Mr. SAVAGE. Yes, sir.

Mr. MARSHALL. What follows then? Do you then abandon the project?

Mr. SAVAGE. We do not.

Mr. MARSHALL. Or does the Secretary go on?

Mr. SAVAGE. The Secretary's judgment is that those lands are well worth irrigation; and in case they should not succeed in selling them, the Secretary is entirely willing to take all the responsibility of disposing of those lands.

Mr. MARSHALL. And he will go on and dispose of them?

Mr. SAVAGE. Oh, yes.

Mr. MARSHALL. Well, that is all right.

Mr. BELL. I am glad you brought that out.

Mr. MARSHALL. I suppose it could not be any other way, or the deed would not be effective.

Mr. SAVAGE. I might say that, comparatively speaking, that tract is one of the better class under consideration by the reclamation service at this time. The quality of the land and the general conditions make it a very safe and desirable investment.

Mr. MARSHALL. Do you think these men will have any representatives here to antagonize this bill?

Mr. SAVAGE. Why, I hardly think so. Their representatives would probably have to come from the Pacific coast. They have a representative there who has assured us at every meeting of his very hearty cooperation, and his belief that it was the best thing for the Government and the best thing for the people that own the lands. He himself owns lands which he proposes to put in on exactly these terms.

Mr. BELL. How long does it take now, under condemnation proceedings, for the Government to get actual possession of land? Have you any idea?

Mr. SAVAGE. No, sir; I am unable to state.

Mr. MARSHALL. It does not take very long. They got possession of a piece here the other day for the Senate office building, and it has happened since the last session of Congress. They are paying the parties now.

Mr. BELL. Down on the Mississippi River, under the laws of Mississippi, they get possession in seven days.

Mr. MARSHALL. Well, I do not know how long it takes to get possession, but I know that we passed a provision for this building at the last session, and they have condemned the land and are paying for it now; so that is not very long.

The CHAIRMAN. Is there anything further on that point? As I understand it, Mr. Newell, Mr. Savage is better informed than any of your engineers here with regard to the Shoshone project and Mr. Savage would like to conclude his statement at this time, so that he can get away.

Mr. SAVAGE. That is entirely optional with you gentlemen. I shall be here several days, and if you prefer——

The CHAIRMAN. I do not want to take up a Wyoming matter at once, in advance of the other matters; but as Mr. Savage is here, and is the only engineer who knows about the Shoshone matter in Wyoming, if there is no objection on the part of the committee he might go on with a brief statement in regard to that enterprise.

(At this point Mr. Savage placed a map of Wyoming on the wall of the committee room.)

Mr. SAVAGE. The Shoshone project in Big Horn County, Wyo., is located about 75 miles east of the Yellowstone National Park. The investigations were begun in May of 1903, the 60,000 acres of the land having previously been withdrawn under the Geary act by Colonel Cody in one of his quarters, and being then under consideration. Our investigations, however, showed that there were about 200,000 acres of irrigable land reasonably tributary to the river, and an ample water supply from the river for its irrigation. The river above the land has a drainage area of about 1,250 square miles, reaching up to an elevation of 12,000 feet. The main source of the river is directly east of Yellowstone Park, and some of the smaller tributaries come from within the park.

The present plans contemplate the irrigation of 150,000 acres on the north side of the river. There is a total of about 34,000 acres at the present time under irrigation or under projected irrigation there by private interests. Topographical surveys were made on a scale of 1,000 feet to the inch at given intervals, and these have been used as the basis of projecting and making the location of the main-line canals.

The CHAIRMAN. The land you propose to irrigate is all Government land, in this case?

Mr. SAVAGE. It is practically all Government land, but the controlling features of it were obtained from Colonel Cody. By an arrangement with him the land was taken back from this Geary segregation, and is now being treated as public land. The gaugings of the stream, which have been carried on since 1892 with more or less regularity, show that there are about a million acre-feet of water running full every year.

The reservoir site is formed by the two forks of the river that come together some 8 miles above Cody Station, the damsite being an unusual one, in a canyon below the junction of these two streams. This canyon is only 65 feet wide at the bottom, the sides rising practically perpendicularly; and at 240 feet (the probable elevation above the stream bed of the top of the dam), the canyon is only 200 feet across. The side walls continue up nearly perpendicularly, and in order to get spillway for the excess floods we find it necessary to design and construct a spillway tunnel. That will have to be something over 20 feet square, taking the flow, of course, from the surface in the reservoir; and it will then be constructed around through the mountain side, discharging back into the stream a few hundred feet below the dam. The outlet works of this project, for this dam, also comprise a tunnel around through the mountain side. It is proposed to discharge about 2,500 second-feet of water. Of course this outlet will be controlled by gates at its head.

As originally designed, it was proposed to take all the water in one canal along the higher elevations of the land, with such lateral distribution as might be required; but borings were begun as soon as the machinery could be gotten there, in August, 1904, and we found that

the bottom of the canyon was full of very large bowlders. We drove diamond drills through these bowlders (one of them 28 feet in diameter), and then came into loose material. We finally reached bed rock at what we believed to be the lowest part of the canyon, at a depth of 88 feet below the apparent bottom, and we continued on with that hole until we got down into bed rock a distance of some 80 feet. We have a number of holes down now in the canyon, and from those we are reasonably sure that we have found the lowest bed rock, although we do not expect to advertise for bids until we have exhaustively examined by borings the entire canyon. We are covering now several hundred feet, ranging up and down, to find a lower place, or a place where it is less depth to bed rock, if possible.

The delay incident to this deep foundation has led us to investigate the possibilities for taking out water for a portion of the lands independent of that high diversion, as it will take at least four years after the beginning of the active construction of that dam before we can get the structure up high enough to store any material quantity of water. We find that a low diversion can be made at a point about 16 miles below the stream, at what used to be a stopping place known as Corbetts, where a tunnel about 3 miles long will take the water out from the river up on to the surface of the land. There is a very heavy grade to that land parallel to the river, and that low canal will cover a total of about 80,000 acres of the lower lands. It is the plan at this time to construct the tunnel full size right away, and the first 20 miles of the proposed main canal for the distribution system will cover about 40,000 acres of the land. The unregulated flow of the river that is not now used will probably supply all the water that land will require for the first two or three years after it is put under irrigation. By that time we will have storage from above, and then we can continue this same large canal on to supply water for the balance of 40,000 acres, or a total of 80,000 acres of the lower land, and also construct the high-land canal to supply the balance remaining of about 70,000 acres of land.

Mr. REEDER. That will make a total of how many thousand?

Mr. SAVAGE. Of 150,000.

The CHAIRMAN. Have you been investigating the question of the feasibility of irrigating some lands on the south side of the river?

Mr. SAVAGE. We have investigated, and we find that the lands on the south side of the river have been made a Geary segregation. The principal owners of that segregation invited us to take the matter under consideration, and we did so. At the request of the local men I made a visit to the chief men interested in the development, and negotiations were carried on for some time; and I was afterwards notified officially that they did not care to take any part in the Government's reclamation project, preferring to undertake to carry on their work alone.

We have a little land that is withdrawn by the Secretary on the south side of the river, and that land is perhaps the better diversion site for the canal to supply the south side lands; and as soon as we complete our investigations and are requested to do so by the people controlling those lands on the south side we expect to relinquish that, so as to in every way promote the desires of the people who want to carry on that private enterprise.

There is another private project going on in that same country,

known as the Oregon basin project, that will take a supply from one of the forks of the Shoshone River above this proposed diversion dam; and there are also two projects under consideration by the Government lower down on the Big Horn River that also may need a little storage water, which perhaps can come from this same high dam—one of them on the Big Horn, opposite Fort Custer, and the other one down lower on the Big Horn, on the right-hand side. All of the possibly irrigable lands tributary to that country are being investigated before final plans are developed and the first construction undertaken.

The CHAIRMAN. Your first construction, then, as I understand you, will probably be of the low line?

Mr. SAVAGE. We hope to advertise for bids for constructing the big dam and the low line at the same time, so that we may get water out on to the lands from the low line about two years in advance of the higher lines. By that means we will have about 40,000 acres under irrigation one year, and perhaps another forty another year, and another forty another year, and the last forty the fourth year. We will have storage water ample to supply all of those lands by the time the last land is under irrigation.

The CHAIRMAN. These lands lie in a reasonably compact body, as I understand.

Mr. SAVAGE. They do—unusually so. They are very well located for irrigation.

Mr. MARSHALL. How near are they to a railroad?

Mr. SAVAGE. There is a railroad running the entire length of the tract along this lowest elevation.

Mr. MARSHALL. I have understood from Mr. Newell heretofore that you do not undertake these projects without being fully advised as to the quality of the land, and I suppose that the question is investigated as to whether it will be profitable or not—what crops, if any, can profitably be raised there. In other words, you would not want to construct an irrigation plan unless you knew that people who bought the lands could make a success of it and pay for it?

Mr. SAVAGE. We investigate every feature of a project and every controlling factor of it—the business end as well. By men in our own employ, specialists who have had training especially along that line. We have them investigate the lands. Mr. Thomas H. Means, of the soils survey, is in charge of that work. We have a number of men in that special work, and they investigate these lands, as to their quality and their need of possible drainage, and the crops that they can produce. There are and have been for several years large areas of land under irrigation in that immediate vicinity that are practically identical in quality with this. That has thoroughly and unquestionably demonstrated the value of the land, and its productive ability.

Mr. TIRRELL. Is there a great difference in the productivity of irrigated lands?

Mr. SAVAGE. Yes, sir.

Mr. MARSHALL. Lots of lands can be irrigated that would become worthless after they were.

Mr. TIRRELL. Do you have any tables or print any information for the country on those lines?

Mr. SAVAGE. Answering that question perhaps in a general way, I will state that these funds originating in these States necessarily have to be expended in those States; and what might be a first-class and a

very profitable irrigation project for Montana would be, comparatively, an unfeasible one in one of the Southern States of our arid regions, where we have a growing season perhaps twice or more than twice as long. We have this department of soils, and that investigation is taking up all those matters of crops and quantities and qualities of crops that are naturally indigenous to each of the projects. Bulletins will be issued, and as full instructions as may be desired will be given to every farmer who wants to avail himself of them regarding the nature and the quantity of the crop he can expect to raise on his lands.

Mr. MARSHALL. That is what I wanted to know.

The CHAIRMAN. Are there any other questions that members of the committee want to ask?

CHARGES FOR CONSTRUCTION.

Mr. REEDER. There is one general question that I want to ask, though I do not know whether it would be better to ask it of this gentleman or Mr. Newell. When these projects are carried to a certain extent and then found not to be feasible for some reason, what becomes of the expense thus far incurred? Is that a loss to the irrigation fund?

Mr. SAVAGE. It doubtless would be; but irrigation projects that are investigated now and not found to be feasible at this time will be feasible in a very few years. There is a demand for land at this time at a price that would, ten or fifteen years ago, have been entirely prohibitive, and a great many projects that we know of now, that can not be wisely constructed at this time, will be in demand in a few years, and then this information that has been collected will be of great use.

Mr. REEDER. Then there is none of this general expense carried to these projects. Now, there is a certain amount of general expense all the while. Is that prorated among the projects, or is there a lot of this expense that simply becomes a loss? For instance, take the general running of the Department. Of course that is more a question for Mr. Newell to answer.

Mr. SAVAGE. I think that is a question that the chief engineer should answer, because that is a matter of policy in the future.

Mr. VAN DUZER. You would not call that loss, would you—the necessary preliminary expense of putting these things together? It is all necessary to carry out the work.

Mr. REEDER. It is not a loss, but it is a loss to the fund. It goes out of the fund and does not return, but it is not a loss.

Mr. VAN DUZER. I know; but there are a good many expenses absolutely necessary for the operation of this work.

Mr. MARSHALL. He is talking about a project that is carried out.

Mr. REEDER. Yes; the general expenses.

Mr. VAN DUZER. He is speaking of general expenses, and the fund, too.

Mr. REEDER. I will not say that it is a loss, exactly.

Mr. VAN DUZER. Well, that is the word I objected to. It could hardly be called a loss.

Mr. NEWELL. If I may be permitted to answer that question, I will say that that is one of the questions which has been under serious consideration. Until other action is taken by the Department, we will probably keep our books in such a way as to eliminate the general

expenses and the expenses of reconnoisance, and charge them into the successful projects; because I think it is the broadest policy not to diminish the reclamation fund.

Of course the general expenses—my salary, for example, and my traveling expenses—are not directly incurred on any one specific project; and yet I am discussing with you to-day a dozen different projects, and that money should be charged to those projects, so far as we can do it, in a general way.

If we charged off these items to general expenses, it would tend to gradually reduce the fund; and I believe the larger public interest will be subserved by charging this into the specific projects which reach completion and keeping the fund up to its full magnitude, because the addition of a few cents an acre does not bear heavily on the farmer himself, but it is of inestimable value in the future.

Mr. VAN DUZER. In other words, you make the general expenses come out of the proceeds of a completed project as soon as it is finished?

Mr. NEWELL. We work them right in, every quarter; we work the general expenses into the charges against the specific projects.

Mr. MARSHALL. That would include, would it, these projects that might be abandoned, say, for the time being?

Mr. NEWELL. For instance, in Idaho we will do a good deal of reconnoissance; we will pick out, as we have picked out, two or three specific projects. I consider that the expense incurred in hunting for those projects and in making up our minds that those things were good really should be chargeable to the successful project when it comes through. That is a matter that of course might be reversed by the Secretary.

Mr. MARSHALL. That is a wise provision.

Mr. VAN DUZER. We have a project reaching completion in the State of Nevada now; in what length of time will that begin to return money into the fund?

Mr. NEWELL. That should begin to return money into the fund in December of next year. We hope to put water on the land in April this year; and the charges are to begin in December.

Mr. VAN DUZER. Succeeding the April in which the water is put on the land?

Mr. NEWELL. Yes; if we put the water on the land by the 1st of April of this year, we will get some money back in this December. If we let it go over the 1st of April, we will expect it in the following December.

Mr. BELL. While you are on that subject, Mr. Newell (as I have a good many inquiries from people in California), let me ask how many acres will be opened at first, and when they will be opened?

Mr. NEWELL. The tract is practically all open now; but we hope to be able to put some water on about 20,000 acres to 30,000 acres during April, 1905.

Mr. VAN DUZER. I will ask Mr. Taylor if that land is all practically applied for now. I believe it is, is it not? If so, when will it be available?

Mr. TAYLOR. The major portion of it has been entered already. In fact, practically all of it has been.

The CHAIRMAN. I would like to make a brief statement on this exceedingly important subject right at this point in order to have it

in the record. I have talked somewhat with Mr. Newell on the subject, and do not take quite the view of it that he does; and I had thought later, when these other matters were out of the way, of calling the attention of the committee to the subject and asking you to go into it. I did not think of its being brought up at this time.

When the reclamation bill was under discussion, some of the gentlemen here who were present will remember that this question of charges was considered one of the most vital questions, and perhaps no other subject took up so much of the time of the committee of seventeen. We went over it pro and con, and in every possible way, and we had all sorts of suggestions as to the charges against irrigated lands. One was that the charges against irrigated lands should be 50 per cent of the actual cost of reclamation; and that was only lost by a very small majority in the committee. Another was that the charge against the land should be $5 per acre. That was considered too low a price in view of the probable cost, but was nevertheless strongly urged. But during the entire discussion of the committee from beginning to end the view was at no time expressed by any member of the committee that drafted the bill that any enterprise should bear any charge except a charge directly connected with that particular enterprise. Further than that, there was a very strong and practically unanimous feeling in the committee that all charges of reconnoissance and preliminary surveys should not be charged against a project, and there was a question in the minds of the committee as to whether any of the supervision of the work should be charged against the project.

I call the attention of the committee to the language of the bill in that connection. The question as to the money to be returned under these projects, and the way in which it shall be returned, is determined by the language of section 4 of the bill, which says:

> That upon the determination by the Secretary of the Interior that any irrigation project is practicable, he may cause to be let contracts for the construction of the same, in such portions or sections as it may be practicable to construct and complete as parts of the whole project, providing the necessary funds for such portions or sections are available in the reclamation fund, and thereupon he shall give public notice of the lands irrigable under such project, and limit of area per entry, which limit shall represent the acreage which, in the opinion of the Secretary, may be reasonably required for the support of a family upon the lands in question; also of the charges which shall be made per acre upon the said entries, and upon lands in private ownership which may be irrigated by the waters of the said irrigation project, and the number of annual installments, not exceeding ten, in which such charges shall be paid and the time when such payments shall commence.

Now we come to the question of paying—the question of charges against the entries:

> The said charges shall be determined with a view of returning to the reclamation fund the estimated cost of construction of the project.

Not the actual cost of the project and of a great many surveys and examinations but remotely or not at all connected with the project, and a great deal of office work that may have been done in connection with this and other projects; but—

> The said charges * * * shall be determined with a view of returning to the reclamation fund the estimated cost of construction of the project.

And until the morning when the bill was finally introduced the word "only" was in the bill after the word "construction"—the words "construction only of the project." It was finally dropped out, not

because the committee was not of the opinion that the charges against the project should be only the cost of construction, but because it was held that that expression was not a good one, and that it was not necessary to use the word "only," inasmuch as the bill carried with it, without that word, clearly the intent of the members of that committee.

Of course, it does not follow, because the men who framed the reclamation law believed that there should be no charges against the entries under a project except those of actual construction, that they drafted a bill which reasonably bears that interpretation. But that that was the thought and the intent of practically every man on that committee that gave the subject any thought or study at all there can be no possible question. It was understood, it was appreciated, that there would be a gradual reduction of the irrigation fund, that gradual reduction being brought about by the office expenses, by examinations of projects not found to be feasible—and you will examine some projects that will never be feasible, though people feel confident that they are feasible when examination is requested. Men that you consider good engineers have perhaps reported them as feasible, but you find they are not feasible at the time examined, and probably never will be; but still it is proper that they should be examined.

Mr. MARSHALL. If you want to be technical about it, you will see that the language there is "the estimated cost of construction." Suppose it cost a half more, according to your technical view of the subject, they could not even add that extra cost.

The CHAIRMAN. They could not; no. There is no question about that.

Mr. MARSHALL. Now, then, as you have said a word for the committee that framed the bill, I will say a word for this proposition, more or less, for the Congress that passed the bill. They made absolutely a rotating fund of this, and they do not expect that it is going to be depleted. And I, for one, do not believe that it ought to be depleted.

The CHAIRMAN. I will say to the gentleman that in the report that was made on the bill, which was published broadcast over the country, and in the speech that I made on the bill, that question was gone into thoroughly; and if I recollect rightly, I was asked on the floor of the House whether or no the reclamation fund would be at all diminished. The answer was "yes"—I think I am right—that the reclamation fund would be slowly diminished, gradually diminished; the diminution being small compared with the entire fund, and gradual, but necessarily occurring by reason of the fact that there would be a lot of office expenses that ought not to be charged against or be divided among enterprises; that there would be reconnoissances and surveys of enterprises that would never be feasible, possibly; in short, that there was much to be done which ought not to be charged directly against any enterprise or any lands under any enterprise. For while we provide for a revolving fund, most of which is to come back into the Treasury, still I do not think that any member of Congress who voted for the bill could have believed that this great scheme of irrigation could be carried on to the end of time, or to the final reclamation of all of the irrigable lands of the country, without any expenditure at all on the part of the National Government. Why, we are expending money in every appropriation bill for the gauging of streams—a hundred or two hundred thousand dollars for the benefit of one enterprise.

Mr. REEDER. Out of this fund?

The CHAIRMAN. No, not out of this fund, but out of the general unds of the Government. It is not even in accordance with the gen- ral policy of the Government to say here that we shall not have the sual and ordinary benefits that industries and enterprises have under he Government; that, unlike a river and harbor appropriation, no enny of which ever comes back to the Government, here are appro- riations coming from the sale of public lands within the States, every nill of which must come back to the Government.

I do not believe there was a statement made on the floor of the Iouse at the time the bill was passed—there certainly never was by ny member who discussed the matter—to the effect that there was to e a full and complete and absolute return of every penny to the eclamation fund. On the contrary, it was understood that there vould be a gradual reduction or diminution of that fund by reason of urveys, office expenses, and a great many other expenses that ought ot to be charged up against these enterprises.

One of the arguments for this law was that there were many irriga- ion enterprises in the country that could not be carried out by private nterprise—first, because private enterprise expected a considerable eturn in the way of interest; but further, that there were large xpenditures in the way of examinations and surveys prior to the con- truction of an enterprise—in some cases so large that, added to the ctual cost of construction, the prices to be placed upon the lands were orhibitive; and that the General Government might properly come n and take the proceeds of the sales of its public lands and construct vorks, charging the settlers every penny that it paid for the irrigation f their lands, as near as it could be estimated, but no more. It must e an estimate, too, because it is settled before the money is paid. When the contracts are let you settle the price. It can not by any ossibility be the exact amount, unless it should happen that the Sec- etary should be able to make a guess covering the exact penny of xpenditure.

But the idea was that the Government could well afford, taking the roceeds of sale of public lands, to sell to settlers these lands without nterest charge, without the charge of office work, without the charge f preliminary surveys—aye, without the charge of any surveys. And hope that that is the view that will be taken by the Secretary when e makes his first charges on these lands. I hope so because it will ot be a matter of a few cents; it will be a large matter in many nstances; and while we may not have written our thoughts into the ational irrigation law, as I read it, it seems very plain that there is o authority in this law to charge against any project any expenditure xcept for the construction of that particular project. Surveys and xaminations and superintendence during the period of construction perhaps might properly be included in the construction, certainly not preliminary work of that kind.

Mr. TIRRELL. Is it not really a part of the construction? If you are going to work to build a house, you have got to put a surveyor on the ground, and you have got to go to work and do the very thing that is done in many ways in these irrigation projects.

The CHAIRMAN. I should not say that the survey of the land would necessarily be part of the construction.

Mr. TIRRELL. Why certainly, Brother Mondell. When you construct a building you have to reckon all those things in.

The CHAIRMAN. When you reckon the cost of a building, yes.

Mr. TIRRLL. I do not think it is an exaggerated or improper way to put it to say that the construction of the building involves those elements.

The CHAIRMAN. Well, I should say that the cost of the building involves that.

Mr. TIRRELL. The construction.

The CHAIRMAN. But not the construction.

Mr. TIRRELL. The construction begins from the inception.

The CHAIRMAN. And certainly it would be an exaggerated view of the thing to say that plans I made for a building that I never constructed should be charged against another building that I did construct.

Mr. TIRRELL. My recollection is that that word "only" was simply questioned as being poor English, and without any debate upon the matter it was stricken out; but that we did not go into an argument as to whether it affected the construction of the sentence as to its meaning, etc.

The CHAIRMAN. If the gentleman will recall—I am sure he will after he has thought of it and recalls the debate—there was a good deal of debate on that particular question in the committee of seventeen. Of course that was entirely unofficial; whatever they said or thought does not matter so far as the law is concerned; but there was a very great deal of discussion in that committee on this particular subject, and I think the gentleman will recall, after thinking over the matter, that it was discussed considerably here.

Mr. TIRRELL. It was discussed considerably here; but what I am criticising is that you are limiting it to so narrow a margin. In other words, you are taking a specific project and are going to eliminate, perhaps, two-thirds of the expense of that very project. (I put it in an exaggerated way, perhaps.) Now, we certainly did not discuss it in that way.

The CHAIRMAN. No; but we certainly did discuss the question that general surveys and examinations should not be charged against projects, or that preliminary and simple reconnoissance surveys should be charged against projects. Of course, however, that is simply a question of how the Secretary shall finally decide as to the meaning of the law. I suppose we can not affect it by any discussion here.

Mr. REEDER. Mr. Chairman, I want to say this—that I have not thought about that question from the time of that discussion until now, and I do not wish to express what I think was the thought of the committee until I look back over the papers. But my own thought was that we purposed keeping this fund absolutely intact. That is the impression which I have had in my mind all this time, and it was my understanding that these estimates that we talked in the committee of seventeen of putting upon the land, after we had concluded that we would make it keep itself intact, were estimates that would be sure to cover the expense, because we figured that the irrigation was going to be exceedingly cheap as compared with irrigation projects usually.

The CHAIRMAN. Well, that is not true as to the majority of the irrigation projects of Government: they are going to cost quite as much as private enterprises, and more in some cases.

Mr. REEDER. Now, I presumed that later there would come a time when we would have to sell the lands under those projects for less than they actually cost, and thus diminish the fund, but that that would occur away in the future, when we had used up all of what might be called the cheaper projects. But it has been in my mind all the while that that fund must be kept absolutely separate; and there is no argument that I used with the members of the House more or to better advantage than the view that "We will never call on you for anything except the use of the money from this land."

The CHAIRMAN. Well, it does not follow that we would do that by reason of the fact that the fund was gradually diminishing; because if you never diminish the fund, and keep on building irrigation works, there will come a time when you will turn back into the Treasury uncounted millions of money. That is the proposition, if you are going to keep the irrigation fund absolutely intact. It means not only not drawing on the Treasury for any money, but it means that the day will some time arrive when we will turn millions into the Treasury.

Mr. REEDER. It will never arrive.

The CHAIRMAN. Well, if you keep the fund intact it must arrive. It must arrive, as a matter of mathematics, if you keep the fund intact.

Mr. REEDER. I simply wanted to be put on record in this way.

Mr. BELL. We can loan it to the national banks. [Laughter.]

Mr. REEDER. My own idea was that we would keep that fund absolutely intact so far as that law was concerned. I think it was understood that there would come a time when we would irrigate lands in the United States that would be an advantage to the United States for which the individuals could not afford to pay fully, but that that would require a new enactment. We will come to that time, too; and we will be very fortunate if we do not come to the time when we want to beg or borrow more money from the Government to carry on the project.

Mr. MARSHALL. Yes, you will be.

Mr. REEDER. But I want to be put on record as saying that it was my understanding that the fund was to be kept absolutely intact, and that I think the Secretary of the Interior's proposition to charge all these expenses up to the various projects is the proper thing.

The CHAIRMAN. There would be no reduction at all if the Secretary guesses (for that is all there is to it—a guess) high enough in his charge against a given project to cover every possible contingency of the construction of that project, and every possible contingency of office expenses and of general reconnoissances and general surveys throughout the country. If that is what the bill means, the Secretary is charged with the duty of making his guess high enough to not only meet it all, but to go above it.

Mr. VAN DUZER. Mr. Chairman, that preliminary reconnoissance work must be done, must it not?

The CHAIRMAN. Oh, certainly.

Mr. VAN DUZER. Well, then, what are you going to charge it against? Where are you going to get the money for it?

The CHAIRMAN. Why, as I said to the gentleman, it has always been my understanding—and I have discussed it often, and, if the gentleman recalls, I wrote the report on the irrigation bill, and specifically referred to that fact in the report, as the gentleman will find by referring to

one of the reports—that there will be a gradual reduction of the amount of the fund by reason of surveys and office work. That was certainly discussed time and time again in the committee of seventeen, rather more than it was in this committee after the matter came here; but I think both of these gentlemen will recall, after they have gone over in their minds the various things we discussed, that there was considerable discussion of that matter here. There was the general principle of a revolving fund to be returned to the Treasury; but it was understood that we were undertaking a great national work, a work of supreme national importance, in which, without drawing upon the Treasury of the United States for a single penny, but simply using the proceeds of the sale of public lands, the settler returned to the fund the cost of construction of the enterprise in which he was individually interested.

Mr. REEDER. Yes.

The CHAIRMAN. And that the fund would gradually be diminished by the amount of the usual and necessary office and survey expenditures covering all of the projects; and that that would result in this: That the irrigation fund would in the course of time, after all the lands had been irrigated, be considerably diminished in volume; but that would be after the work of reclamation had been carried out. At least, Congress certainly understood that some obligation rested on the Government under this bill, and not that it was simply acting as agent for the people settling upon the lands and doing their work for them.

Mr. VAN DUZER. I do not think we will ever get through with irrigation, because I think that eventually the people of the East will see that it is a good thing and they will be clamoring to get in on this proposition.

Mr. BELL. You have not got anything back here that you can use water on. (Laughter.)

The CHAIRMAN. A gentleman from South Carolina wanted to know the other day if he could not use the fund for the drainage of his country.

Mr. BELL. I would like to ask the question on a general feature. Where public lands are irrigated and opened for settlement, does the Department of the Interior fix the price that the settlers must pay?

Mr. MARSHALL. It is $1.25 an acre for the Government land, is it not?

Mr. BELL. That is what I want to know.

The CHAIRMAN. Do you refer to the charge for water?

Mr. BELL. No; the price of the Government land to the settler, where Government lands are irrigated. What is the price?

Mr. MARSHALL. They pay how much for the land?

The CHAIRMAN. The settler pays nothing for the land?

Mr. BELL. That is what I want to know.

Mr. REEDER. They live on the land.

The CHAIRMAN. The settler pays nothing?

Mr. BELL. That is the point I want to know about.

Mr. MARSHALL. That is the Geary Act; I have gotten that mixed with it.

Mr. REEDER. Let us proceed with the hearings now, Mr. Chairman; we can hear ourselves at almost any time.

The CHAIRMAN. Mr. Newell suggests that we hear Mr. Ross—Mr. D. W. Ross.

TEMENT OF D. W. ROSS, ESQ., IN CHARGE OF RECLAMATION WORK IN THE STATE OF IDAHO.

[r. Ross. Mr. Chairman and gentlemen, as Mr. Newell stated, I in charge of the work in Idaho. The reclamation service began stigations in Idaho immediately after the passage of the act. ut a year before that time arrangements had been entered into ı the State, which was conducting, through the office of the State ineer, investigations in cooperation with the Geological Survey; hat at the time of the passage of the act there was considerable ı available for extending these investigations and of sufficient ıracy to enable the reclamation service to reach definite conclu- s regarding certain possibilities in the State. As a result of that a ject was taken up and concentrated on in the Snake River Valley, wn as the Minidoka project. If you will allow me to remove this). I will show you what I mean.

/e have here, I suppose, the map of Idaho, and as the tract in stion is not laid out like these patches I can indicate the locality t. The Minidoka tract lies right here, on this bend of the river, I will explain that this patch here represents the withdrawal—the ry act segregation—known as the Twin Falls project. This is the ;ral portion of the Snake River Valley. These two large bodies and constitute the only irrigable areas in this part of the State. Minidoka tract comprises an area of irrigable land of from 120,000 50,000 acres; this tract has an area of about 240,000 acres, making gether nearly 400,000 acres in that section.

he water supply for these lands will be obtained from the Snake er. As you know, the Snake River rises in the western part of oming, near the Yellowstone National Park, and supplies practi- y all the water used for irrigation in this great central valley—the ıt valley extending clear across the State.

he river furnishes an abundant supply of water for the irrigation ll the lands which are tributary to it during the seasons of flood, during some years it may furnish almost enough during the entire on, but in making up our estimates on this point we assume that will be obliged to store water for a considerable part of the season, in fact for the irrigation of these lands practically half the water l during the season will be drawn from storage reservoirs. These rvoirs are nearly all situated in Wyoming, just across the State , and they consist of large lakes, which can be developed for stor- purposes at a comparatively small expense.

he lands under the Minidoka project are practically all Government s, or were less than a year ago. The State owns about 25,000 s, consisting of small areas of school lands——

[r. REEDER. Please tell me where this tract is. I have rather lost run of it, as I stepped out for a moment.

[r Ross. At that point [indicating], about half way across the State.

[r. REEDER. In Idaho?

[r. Ross. Yes.

[r. REEDER. I did not even know what State it was.

[r. Ross. The recommendation for the withdrawal of these lands er the provisions of the reclamation act was made in October, 1902. he spring of 1903 surveys were begun, and in December a prelim-

inary report was submitted to the chief engineer, which will be found in the second annual report of the reclamation service. In the following April a board of consulting engineers passed on the plans for the work, and immediately after a recommendation was made to the Secretary, to the end that construction be undertaken at once. Following this recommendation, invitations were sent out for bids. In July following these bids were opened; in August the contract was awarded, and the contractors are now on the ground and work is under way.

The first section of the work contracted for consists of a dam in Snake River and a spillway. This dam will be about 600 feet long, and will raise the water about 43 feet at its low stage and about 47 feet at flood. The construction of a spillway, which will be about 3,000 feet long, will give splendid control of the system. In addition, there is the construction of the rock portion of the canals, which divert at that point, the material excavated from the canals to be put into the dam. This contract will involve an outlay of approximately $350,000.

Mr. MARSHALL. What will it cost the settlers to get the water on this land?

Mr. REEDER. Per acre?

Mr. ROSS. The price fixed by the secretary is $26 an acre. During last season surveys were made for a distributing system, and we are now preparing plans and estimates for the same, with a view of letting contracts within the next two or three months, we hope, for the construction of practically the entire gravity system of canals.

A part of these lands, about 80,000 acres of them, can be irrigated by gravity. The remainder will be reached by pumping, and a very large power development will be undertaken at the dam. The facilities for the purpose are exceedingly fine.

Mr. MARSHALL. Where do you get this water for pumping; do you pump it out above somewhere?

Mr. ROSS. They pump that water to levels above the gravity system.

Mr. WILLIAMSON. Have you estimated the cost per acre of the water in the pumping system?

Mr. ROSS. That is included. Inasmuch as there are lands on both sides of the river to be reached by pumping, and it will be under one management, one association, it was thought best not to make any division at all, but it will all go in at the same cost per acre. Besides, owing to the fact that the facilities for pumping are unusually good, and the development can be carried on very cheaply, there would be but very little difference anyway; so there could not very well be any distinction or difference in the cost.

Mr. REEDER. Let me ask this question: How many acres of this land are watered by means of pumping, or what percentage of it?

Mr. ROSS. There will be, say, about 80,000 acres reached by gravity.

Mr. REEDER. Yes.

Mr. ROSS. Now, the extent of the lands which can be reached by pumping will depend entirely upon the amount of water available for power purposes.

Mr. REEDER. What is the source of that water for power purposes—what is the source of the power?

Mr. ROSS. That is the natural flow of the river.

Mr. REEDER. That is the water that comes from the dam?

Mr. ROSS. Yes.

Mr. REEDER. And after it serves for those power purposes it passes into the canals for irrigation?

Mr. ROSS. No; I will explain that. The reason I mentioned this large project is that this large Geary-Act project known as the Twin Falls enterprise was begun about four years ago, and is now under course of construction, and enjoys the prior right to the natural flow of the stream; so that in making our plans for the power we proceeded on the theory that this project would be entitled to the natural flow of the stream, and that supply would be available for power purposes. In that way there would be no conflict of rights. It happens that the minimum flow of the stream is a very large amount, about 2,000 second-feet, and the capacity of these canals is about 3,400 second-feet; so that when these lands are provided with their full supply of water a portion of which will have to be provided by storage, we will have available for power purposes 3,400 second-feet. In carrying out the pumping plan, therefore, we can proceed to the limit of the supply available for power, and do that without causing any conflict with any other project.

Mr. REEDER. I see.

Mr. LIPPINCOTT. Mr. Ross, I do not think they understand how you utilize that power—where it is developed.

Mr. ROSS. It is developed right at the dam.

The CHAIRMAN. Is it developed by raising this water and dropping it?

Mr. ROSS. No; we create a fall at the dam itself of approximately 50 feet. This entire volume of 3,400 second feet falls 50 feet.

Mr. MARSHALL. In other words, the natural flow of the stream falls that much?

Mr. ROSS. That is it.

Mr. MARSHALL. And the water goes on to be used by the Geary-Act project?

Mr. ROSS. That is the idea. The lands which we will reach by the pumping system lie above the gravity system; and since the area of such lands is almost unlimited, we can extend the pumping system just as a [illegible] conomy in doing so.

Mr. TIRRELL. When will these 80,000 acres be open for use?

Mr. ROSS. The 80,000 acres and, in fact, all of the lands have been subject to entry from the inception of the project; but no one saw fit to enter the lands until the plans of the Government were pretty thoroughly matured. In fact, last May there were no lands entered. I do not think there was at that time a single entry on the Government lands. As soon as the announcement was made by the Secretary of the intention of the Government to construct the works, within a few weeks' time the lands were eagerly sought after, and to-day practically all of the public lands that are designated as irrigable have been entered.

Mr. MARSHALL. You see, when these lands are segregated you can always file on them just the same, as I understand; but what you mean is, when does the water go on the land?

Mr. TIRRELL. Yes; that is what I mean. When will the water be on the land, so that they can begin to use it for agricultural purposes? That is what I want to know.

Mr. ROSS. Yes. As I stated, the work on the dam is now in progress.

We hope that contracts will be let for the construction of practically the entire gravity system of canals early this coming season, and that construction will begin at once. The work is of such a nature that if we get an early start practically the entire system can be constructed this season; and while we do not advertise to the people that they are likely to get water in the spring of 1906, we hope and are of the opinion that they will.

Mr. WILLIAMSON. I do not exactly understand the difference between the pumping and the gravity systems that you mentioned. Now, if I understood you correctly a moment ago, you said that the original cost of the reclamation by the pumping system about equaled the cost of reclamation by the gravity system?

Mr. ROSS. Yes.

Mr. WILLIAMSON. I was speaking of the maintenance; I was speaking of the annual charge for water under each system. Is there not a difference in the cost of producing water by pumping and the cost of water running down by gravity?

Mr. ROSS. There will undoubtedly be some difference; and that is a matter that may have to be adjusted later on—the cost per annum for maintenance.

Mr. WILLIAMSON. That is what I was trying to get at. You can not state that—the cost per annum of these lands that are irrigated by the pumping system?

Mr. ROSS. No.

The CHAIRMAN. That will have to be settled, anyway, by the people under the canals.

Mr. REEDER. I would like to suggest that I do not think Mr. Williamson has quite caught the idea. I think that has been already settled, as to the cost of these lands; and they figured in this way—that if they have to build a dam 40 feet high to furnish power to pump the water, and that same dam is used for the purpose of furnishing the gravity water, they might as well call it all one job and divide it equally.

Mr. MARSHALL. Yes; but what he is talking about is the maintenance.

Mr. WILLIAMSON. The maintenance after it is once irrigated.

Mr. MARSHALL. When the land is paid for.

Mr. ROSS. In answer to that I will say that——

Mr. WILLIAMSON. I certainly do not think that water can be pumped as cheaply as it can run in the gravity system after it is once constructed.

Mr. REEDER. Well, if you have to build a large dam to provide that gravity flow, and then if water that otherwise has to be wasted can do the pumping, I tell you there is not very much difference in the cost under the two systems. But that is a matter to be settled in the future, and we have not anything to do with it here now, anyway.

Mr. MARSHALL. I think we have a pretty good idea of that plan. Have you anything more to say?

Mr. ROSS. No; my purpose was merely to give a general idea of the situation.

Mr. REEDER. How far is that tract from Boise city?

Mr. ROSS. About 200 miles.

Mr. REEDER. Oh, it is? What is the largest city near it?

Mr. Ross. Pocatello is the nearest point of importance. Pocatello is situated about 60 miles east.

Mr. REEDER. East of this project?

Mr. Ross. Yes; east of this project. The Oregon Short Line Railway passes about 6 miles from the nearest point, and the town of Minidoka is the nearest station. But the Oregon Short Line people are now constructing a branch railway, which leaves the main line at Minidoka and bisects the Minidoka tract, crossing the river at about this point [indicating], and then continuing down through the Twin Falls tract.

Mr. REEDER. Oh, yes; so it gives them railroad facilities?

Mr. Ross. Yes.

Mr. TIRRELL. Just in a word, what do you anticipate the farmers will raise there?

Mr. Ross. The principal crop will be alfalfa, but there will be considerable diversity in the products. It is what we designate as a three-crop locality—that is, they will make three crops of alfalfa each season. That will give you a general idea of the probable value of the land.

Mr. REEDER. What is the size of the home sites in that section?

Mr. Ross. Eighty acres.

Mr. VAN DUZER. How many tons to the acre can be raised in the three crops?

Mr. Ross. They will raise about 6 tons to the acre.

Mr. VAN DUZER. Six tons?

Mr. Ross. Yes.

Mr. VAN DUZER. From three cuttings?

Mr. Ross. Yes; I think that would be a fair average.

Mr. REEDER. What is its market value out there? Do you know anything about that?

Mr. Ross. I can only refer to the——

Mr. VAN DUZER. We can beat that in Nevada.

Mr. REEDER. Can you?

Mr. VAN DUZER. I think we can ring in four crops.

Mr. Ross, I am supposed to be conservative in my statements. [Laughter and applause.] I should say 10 tons to the acre in this valley; but since——

Mr. REEDER. Well, I want to inquire about the price per ton.

The CHAIRMAN. My impression was that you were trying to get high enough so that the gentleman from Nevada could not "get back."

Mr. REEDER. I want to ask you about the price per ton, if you know.

Mr. Ross. Well, that fluctuates; that varies. In this section [indicating], a year ago last fall, the farmers were selling alfalfa for $10 a ton in the stack.

Mr. REEDER. Yes.

Mr. Ross. Last fall, however, it was down to $5.50 and $6. In this valley [indicating], the Upper Salt River Valley, the average price is about $4 in the stack.

Mr. REEDER. Yes.

Mr. Ross. That is a two-crop country.

Mr. BELL. The price of beef has a good deal to do with the price of alfalfa, has it not?

Mr. Ross. Well, it is pretty hard to tell in these days whether it has or not. That is a delicate question.

Mr. VAN DUZER. It depends on the beef trust.

Mr. BELL. Is that a beef country or a cattle country?

Mr. Ross. The price of alfalfa in that country depends very largely upon the sheep industry.

Mr. BELL. The sheep?

Mr. Ross. Yes.

Mr. REEDER. I was trying to get at the value of the land when it is irrigated.

Mr. MARSHALL. Is there any irrigated land there now?

Mr. Ross. Only one small tract.

Mr. MARSHALL. At about what figure do they value it; do you know?

Mr. Ross. Well, I think I can give the value of the land—a pretty close estimate of it, anyway. We are of the opinion that the lands will be worth from $50 to $75 an acre.

Mr. MARSHALL. So it is going to be a nice thing for the homesteader that gets 80 acres of it?

Mr. Ross. That is, in the early period of development.

Mr. WILLIAMSON. In the raw stage.

Mr. Ross. As soon as the water is available. There are some of the best lands of this tract which I am satisfied can not be bought for less than $75 an acre two years from now.

Mr. WILLIAMSON. Yes.

Mr. Ross. That is, some exceptionally fine pieces.

Mr. VAN DUZER. How close to Mountainhome is that?

Mr. Ross. About 130 miles.

DUBOIS PROJECT.

We have another project, known as the Dubois project, under investigation in the eastern part of the State in the western half of Fremont County. There is in this project an area of about 200,000 acres of irrigable land. That is, there is an area of probably 500,000 acres of very beautiful desert land which it would be very desirable to reclaim; but the amount which we will reclaim will depend entirely upon the water supply. We have been pretty conservative in our preliminary estimates, at least in our estimates of the water supply, and have assumed that we would be able to reclaim 200,000 acres of that area. That involves the construction of a vast storage system which will utilize nearly all the sites on the North Fork of the Snake River and some of the storage basins in Wyoming and on tributaries of the North Fork.

We have only made preliminary investigations of this project. We have made pretty careful examinations of the land, surveys of canals, of the main diversion canal from the river, and so on, but have confined most of our detailed investigations to the storage facilities, because the water supply is the key to the entire situation in connection with that project. We concluded our storage investigations early in November and the results were very satisfactory, so that we now class the Dubois project as among the feasible irrigation projects.

All of these lands belong to the Government. There are practically no entries on them at all, and no State selections; and we may be able to swell that area to 250,000 acres. We think we may have water enough for that amount; but we are certain of water enough for *200,000 acres.*

PAYETTE-BOISE PROJECT.

Another large project is what is known as the Payette-Boise project, named after the two valleys in the western end of the State. That is one of the principal projects in the State. It is the one in which the major portion of the land to be reclaimed belongs either to private parties or to the State. In that project we will reclaim about 300,000 acres of desert land, and there will be included within the boundaries of the enterprise about 65,000 acres of land either wholly or partially irrigated at the present time.

The water for the Payette-Boise project will be supplied by the Payette and Boise rivers. The Payette River has a very fine water supply—in fact, it is one of the best streams used for irrigation in the West. It not only has a steady flow, but has splendid storage facilities. The Boise River has a very large flood discharge, but it gets quite low toward the latter part of the season, and we have not found very good storage facilities on the headwaters. But the flood discharge occurs at such a season that it is all available for irrigation—that is, it comes when it is most needed. In fact, it is possible to make two cuttings of alfalfa from irrigation from the flood waters alone, so that even if we could not store any water at all I feel perfectly safe in stating that it would be entirely feasible and desirable to irrigate the lands of the Boise Valley. That is the largest project in the State, and one in which the human interest is at present most concentrated—in which we come most in contact with the people.

Perhaps I should give some idea of the cost of these enterprises.

Mr. MARSHALL. That is a good idea. We do not care so much about what the plant is going to cost—at least, I do not—as what the acreage cost is. The committee would no doubt like to know the whole thing, however.

Mr. ROSS. An allotment of $2,600,000 has been made by the Secretary for the construction of the Minidoka works. We can only estimate very roughly the cost of these works, because our investigations are only of a preliminary nature; but we think the lands can be reclaimed at a cost of about $25 an acre. For the Payette-Boise project we estimate a lower cost per acre. It will probably be from $15 to $20 dollars per acre.

Mr. WILLIAMSON. How much will the cost be per acre of a simple diversion, without storage—the simple diversion you spoke of a moment ago, by which you could get two crops?

Mr. ROSS. If we could make a division of the project so that the lands of the Boise Valley, for instance, would only pay the cost of main canals, we could irrigate, say, 250,000 acres, at a cost of not to exceed $12 per acre.

Mr. WILLIAMSON. By diversion?

Mr. ROSS. Yes; and that would not involve any engineering difficulties whatever. It would be the very simplest construction.

Mr. WILLIAMSON. Do you consider that the present law would admit of that—furnishing water the year round without storage and reservoirs? Do you consider the present irrigation law would allow you to irrigate and reclaim land by simple diversion?

Mr. ROSS. I should think it would.

Mr. MARSHALL. Well, for this diversion you would have to build a dam, would you not?

Mr. ROSS. It would be necessary, in that case, to construct a low diverting dam.

Mr. WILLIAMSON. I have the same impression that you have; I just wanted to see what your impression was.

Mr. ROSS. Yes. That, Mr. Chairman, is a general outline of the projects.

The CHAIRMAN. The discussion of the matter of diversion, and the possible raising of one crop there, brought to my mind another matter on which I would like to have your opinion. That is as to the advisability of assuming a high duty of water in connection with these Government projects. Is it your opinion that it would be wise, generally, to assume a high duty of water, in order to include within the project the very largest possible acreage, or to assume a low duty of water, to assure abundant supply and perhaps a superabundance in later years, when the land is thoroughly soaked up, and thus irrigate a smaller acreage?

Mr. ROSS. In my opinion that depends wholly on the conditions surrounding each project. Where the water-supply is furnished by reservoirs, and where the land will probably have a high value after its reclamation, I think we should assume a high duty of water. Of course that, again, depends upon the kind of crops to be raised. But in the case of a stream like the Boise River, for example, I think we will be forced to take into consideration the conditions of the flow, the seasons during which an abundant supply can be had, and also the kind of crops. In that particular case we can make two cuttings of hay and harvest one crop of grain from the natural flow, and put practically every acre of land under cultivation, and get results which will, perhaps, be very much more satisfactory than can be obtained in any of the Mississippi States, for example. You will raise more per acre; it will be more profitable, too. I think we should make our calculations on some such basis as that, but no rule can be laid down, in my opinion. We must take into consideration the natural conditions in every case.

The CHAIRMAN. The question, of course, is entirely one of administrative policy with the Department. The absolute duty of water for certain territory can not be known in advance. It is, of course, impossible for finite wisdom to know what the duty of water is in a certain locality and on certain land without trial. You have to make the best possible estimate from your knowledge of the locality and conditions, and under the law, of course, the Secretary is not bound to assure to the settler an abundance of water at all times, in the dryest of seasons. I suppose it is assumed that the work shall be carried out, so that under ordinary conditions the settler will have a reasonably abundant supply of water. It becomes a pretty large question, then, I should think, in every one of your projects, as to what duty of water you shall assume—how much land you assume a cubic foot of water will ultimately reclaim. If that duty is made low, and you dispose of 100,000 acres of land under a given project and twenty years afterwards it is discovered that there was water enough to irrigate 125,000 acres, you have lost (for the time being, at least) 25,000 acres of irrigation which might have been obtained. On the other hand, if the duty of water is made so high that it leaves the settler short during an average season, that would, of course, be a most unfortunate condition.

Mr. ROSS. In many cases the duty of water during the early part of the season will necessarily be low, and, owing to the fluctuation of the stream in cases where it is impossible to regulate the flow of the stream, it will necessarily be high during the latter part of the season; so that we may have under one project a duty of water of, say, 60 acres to the second-foot during the June flow of the stream, and 150 acres to the second-foot during the August flow. But that is just about as the settlers would have it were they building these canals themselves. There is no escape from that result under the conditions which will exist.

The CHAIRMAN. My personal opinion—it is simply, of course, a matter of opinion, because it is something with which the committee has nothing to do; it is a matter for the service—is that for various reasons it is the part of wisdom, under these projects, to assume a pretty high duty of water. One reason is that we want to get as much land as possible under irrigation in the arid region with the water we have; and another is that with a very high duty of water there must be economy in its use. The settler is compelled to use his water economically, and as it is distributed by the Secretary or by the association organized under the law, there would be an equitable distribution even when the supply was a little short. But with a high duty of water assumed under a project every possible acre would be brought under cultivation, and the settler would be compelled to practice that economy of use of water which is necessary for the best development of an irrigated country. Of course we all appreciate the tendency of the settlers to use an enormous amount of water if they have it—generally more water than they need, and often so much water that they injure their lands.

Mr. REEDER. And more often injure their crops.

The CHAIRMAN. That is a suggestion to the service. I know those matters are all discussed among you.

Mr. ROSS. If there are no more questions, that will complete my statement.

The CHAIRMAN. I believe there are not.

STATEMENT OF I. W. M'CONNELL, ESQ., IN CHARGE OF UNCOMPAHGRE VALLEY PROJECT, COLORADO.

Mr. MCCONNELL. Mr. Chairman and gentlemen, the reclamation work in Colorado has been under Mr. Fellows, and I have been assigned particularly to the Uncompahgre Valley project, or, as it is commonly known, the Gunnison Tunnel project.

That tract is located in the southwestern part of the State, in the black spot indicated here [referring to map]. It is some 300 miles from Durango and four hundred and forty-odd miles from Denver by the Denver and Rio Grande Railway, lying on the narrow gauge, and practically in the heart of the Rocky Mountains. The elevation of the lands, which lie on both sides of the Uncompahgre River, is between 4,800 and 6,250 feet. The valley is compact, being 10 miles in width, as a general average, and 30 miles in length from the extreme southeastern part to be irrigated to the northwestern portion.

The valley was first settled in the early eighties by the opening of the Ute Reservation, in southwestern Colorado. The white settlers

went in immediately and took up a very large proportion of the lands, expecting to irrigate them from the Uncompahgre River. The water supply failed in a very few years, and at the present time there are about 30,000 acres under partial cultivation, with 10,000 acres probably cultivated to within 75 per cent of their maximum efficiency.

The reclamation project proposes to irrigate about 150,000 acres in toto. Of this amount probably 100,000 acres had been filed upon prior to the segregation for the benefit of the act; and out of that 100,000 acres the owners of the greater portion, or approximately 94 per cent, have subscribed to the regulations laid down by the Department and will participate in the benefit. Up to this date that subscription is 94 per cent. We anticipate that before the works are built practically the entire privately owned land of the valley will come in.

The proposition, from an engineering standpoint, is to divert some 1,300 second-feet of water from the Gunnison River into the Uncompahgre Valley. That diversion must be made by means of a tunnel 10 by 12 feet, roughly, in cross section, and 30,000 feet long, more or less, cutting under what is known as the Vernon Mesa, a ridge which rises to a total elevation of 8,600 feet, or, roughly, 3,000 feet above the floor of the Uncompahgre Valley.

Mr. REEDER. Let me ask this question: Is that tunnel placed high enough to make anything of a water power?

Mr. McCONNELL. Yes, sir. The elevation of the tunnel is about 6,470 feet at the Uncompahgre Valley end. To reach the irrigable lands it must fall about 200 feet, and that total fall will be available for power purposes. It is intended to carry almost the entire amount of water diverted from the Gunnison River to the Uncompahgre River in what we call the south canal—a canal some 15 miles in length. Almost immediately from that point where the waters from the south canal enter the Uncompahgre River there will be diverted some 834 second-feet into the west canal, a canal which will be some 35 miles in length, and which will irrigate in the neighborhood of 45 per cent of the lands of the valley by means of its laterals.

This west side has been the preferred land heretofore, and is for the most part a sandy loam, very fertile, a light soil, somewhat gravelly, which plows readily, and is adaptable to all the crops which are possible in the irrigated regions.

The east side of the valley will also be served by a canal some 30 miles in length, which will carry 640 second-feet.

The residue of the waters diverted from the Gunnison River and the flood waters of the Uncompahgre River will be used to supplement the supply for the present system of canals in the valley, of which there are some four or five of considerable importance. The present cultivation indicates that the lands are adaptable to fruits—that is, the deciduous fruits, apples, apricots, plums, prunes, and peaches. The most profitable fruit crop, apparently, is the peach; it comes to maturity earlier and yields enormously.

The CHAIRMAN. What is the average elevation of the irrigated area?

Mr. McCONNELL. The elevation of the irrigated area is from 6,200 to 4,800 feet.

The CHAIRMAN. Do they raise peaches at an altitude of 6,000 feet?

Mr. McCONNELL. Most magnificent peaches. Mr. Reeder will bear me out in that testimony.

Mr. REEDER. I never saw such peaches as I saw there last year.

Mr. McCONNELL. What is known as the Ashemfelter orchard shipped this year, from 40 acres, 7 carloads per week for five consecutive weeks. In other words, the yield of that 40 acres was more than 35 carloads of peaches.

Mr. REEDER. And they sold them at $4 a bushel.

Mr. McCONNELL. They bring 50 cents a box.

Mr. VAN DUZER. How many boxes to the acre?

The CHAIRMAN. That is a better story than Ross's. [Laughter.]

Mr. McCONNELL. He told his story first.

Mr. VAN DUZER. This is good information to the East, you know.

Mr. MARSHALL. What is it going to cost to put the water on these lands?

Mr. McCONNELL. The articles of association, as drawn by the reclamation service for the signature of the private holders, call for a maximum of $25 per acre.

Mr. MARSHALL. What are those lands worth which are irrigated there now, and to which you referred?

Mr. McCONNELL. I know of lands in that country which can be bought at the present time for $10 an acre. I know of other lands which can not be touched for $250 an acre. I know of lands on the North Fork, a contiguous valley which leads into the Gunnison River Valley almost opposite the point where the Uncompahgre flows into the Gunnison, that are held at $1,000 per acre. [Laughter.]

The CHAIRMAN. Those are producing fruit lands, are they?

Mr. McCONNELL. Yes, sir; those have the orchards set, and have been productive. I might retail a great many stories of that sort. I may say, incidentally, that my relatives (my mother's brother, and so on), were among the earliest settlers in that country, so that I am fairly familiar with the conditions; and I know of one case where a man bought a nine-acre orchard (well set, of course, and in prime condition), for $3,600; he supported his family and paid for it in two years.

Mr. TIRRELL. Are there any difficult problems connected with this project?

Mr. McCONNELL. The difficult problems are purely of an engineering character and arise chiefly from the size of the tunnel. A tunnel 30,000 feet long is a rather serious proposition.

Mr. TIRRELL. That will take you some time.

The CHAIRMAN. How large a percentage of the land is in private ownership?

Mr. McCONNELL. Two-thirds, roughly speaking.

Mr. REEDER. What is the cause of the difference in price of those lands? Is it in their improvement or location, or is it due to an actual difference in fertility?

Mr. McCONNELL. No, sir; it is mainly in the improvement—that is, in the improvement and in the water supply. When it developed that the water-supply of the Uncompahgre River was totally inadequate for that land, great areas reverted to desert conditions. They stand there to-day with the furrows in the ground.

Mr. REEDER. I thought you were answering the question as to the value of the land with the water supplied as it will be by this project.

Mr. McCONNELL. No, sir.

Mr. REEDER. I would like to inquire what the values of those lands will be—that is, the reasonable values; what the settlers would hold them at or would sell them at.

Mr. McCONNELL. After the Government system is complete?

Mr. REEDER. Yes.

Mr. McCONNELL. It is my belief in that matter—and I base it upon investigations which I have reported in due course to the Department; that is, I am on record—that there is no land which we now propose irrigate that will not pay a ten per cent or greater income on $100 per acre. Now, you may cut that in two and you still have a good business proposition.

Mr. MARSHALL. How long, approximately, will it take to complete this tunnel?

Mr. McCONNELL. The contract for the tunnel calls for its completion on the 15th of April, 1908..

Mr. MARSHALL. That is let, is it?

Mr. McCONNELL. Yes, sir; that was signed last week, as I am informed; and it will be possible to have the canal system ready by that time.

Mr. BELL. What is the cost of that—$1,000,000 or so?

Mr. McCONNELL. Approximately $2,500,000.

Mr. BELL. That tunnel?

Mr. McCONNELL. Oh, the tunnel? $1,008,000, according to my recollection.

Mr. REEDER. And 500.

Mr. MARSHALL. Let me ask you another price question. How does the contract price correspond with your estimates? How do they come together?

Mr. McCONNELL. The contract price is, as I recall it, 10 per cent beneath my individual estimate of the cost. I may state——

Mr. MARSHALL. Was your estimate adopted by the service, by your superiors?

Mr. McCONNELL. I referred it to the board of consulting engineers, and they approved the letting of the contract, so I suppose it must have been.

Mr. MARSHALL. I will get you to build a house for me. [Laughter.]

Mr. NEWELL. I would like to say that we have been very fortunate in that our bids so far have run, I think—the gentleman will correct me if I am wrong—under our estimates. As a rule they run well under them.

Mr. McCONNELL. I might state in this connection that the main local industry upon which the valley depends at the present time is stock raising.

Mr. MARSHALL. I suppose the contractors have the usual way of getting at these estimates, have they not?

Mr. NEWELL. No; we do not let the contractors know what our estimates are.

Mr. MARSHALL. I should think that was important.

Mr. NEWELL. So far as possible we keep them absolutely to ourselves.

Mr. MARSHALL. That is a good idea. I was thinking that these sums that are set aside for these purposes are of no value to them, then?

Mr. NEWELL. Oh, no.

Mr. MARSHALL (to Mr. McConnell). Pardon me; I thought that was of importance.

Mr. McCONNELL. The matter of which I was speaking is not important; simply that the present occupation of a large number of the people is that of stock raising. There is an almost unlimited cattle and sheep range around there; and the best market for wheat, potatoes, and sugar beets is found in the vicinity.

Mr. MARSHALL. There are beet-sugar factories there, of course?

Mr. McCONNELL. There is one at Grand Junction now.

Mr. MARSHALL. Yes; I know.

Mr. McCONNELL. Incidentally, we are trying to promote one at Montrose, but have not yet succeeded.

Mr. NEWELL. Mr. Chairman, if the committee will permit a remark in defense of my method of bookkeeping, I would like to say this:

Suppose we take this Uncompahgre Valley project. We could figure the estimated cost of that by cutting out all preliminaries, and cut it down perhaps to $23 an acre. The land is worth, when the water is on it, $50 or $100 an acre. Now, it seemed to me the part of wisdom to let that price to cover contingencies go up to $25 an acre (which will be, say, $2 an acre on 100,000 acres, or $200,000) because the land is worth so much more than it cost, and if we can recover and keep in the reclamation fund, say, a couple of hundred thousand dollars extra it is better financiering; we stand better with the people than if we permitted a loss of 10 per cent.

Of course our preliminary estimates are simply preliminary; we must make them according to law, and we must stick by them. If the project costs us more than our estimate, no one is going to excuse us. It will be said, "Oh, that is bad engineering." If we estimate carefully and thoroughly, and yet come a little above the actual cost, we will be commended as good, sound business men. But I do not think any excuse will ever be tolerated in the mind of the average business man for underestimating, and letting the people have this land for a little less than it actually cost the Government, when it is worth a great deal more.

I can see the case to which the chairman called attention, where the land may not at present be worth what it would cost with all these incidentals put on. But for the future we can see that every piece of land reclaimed is worth a great deal more than it is going to cost the people; and we not only have need for the money, but we have projects under consideration which will require every dollar that can be kept in the fund. And while I may be mistaken in this, yet the policy has been to charge up these incidental expenses and retain the fund, because in the immediate future we will need every dollar of it for the projects under consideration.

Mr. MARSHALL. Mr. Newell, I might suggest that you are liable to subject yourself to serious criticism in doing that, as you will be in such striking contrast with every other thing with which the Government ever had anything to do. [Laughter and applause.]

Mr. NEWELL. Well, I hope, gentlemen, that it is not presumptuous to say that we are trying to organize an engineering corps, and, more than that, a good business corps of men to make these things come out right. Of course, we will make mistakes, I assume; but starting with the character of men that you see before you, I believe it is practicable to carry this thing on upon a strictly business basis, and to make it pull through on that line.

Mr. REEDER. The question I wanted to ask is, What is the unit of homestead, or what is the number of acres in the homestead in that section—the Montrose section?

Mr. McCONNELL. The last information I had was 80 acres, although I believe there are certain tracts which are of unusual value that will be cut to 40 acres, and certain others that have adobe hills sticking up in them or running through them that will be made larger—perhaps 120 acres.

Mr. REEDER. Is it possible for any family to cultivate 10 acres of that soil in fruit without hiring help?

Mr. McCONNELL. Ten acres, did you say?

Mr. REEDER. Yes; 10 acres.

Mr. McCONNELL. Well, that will depend on the size of the family.

Mr. REEDER. I mean an ordinary family.

Mr. McCONNELL. Yes, sir; an ordinary family would have a very busy time with 10 acres.

Mr. REEDER. I asked that question because I have some relatives living at Canyon City who bought 7 acres. There are two men in the family, and they have employed help for the last fifteen years, and they have been taking care of 7 acres.

Mr. McCONNELL. Yes, sir; I know.

Mr. REEDER. They have made plenty of money out of it; they have made themselves rich off of the 7 acres.

Mr. McCONNELL. I know a Swede in that country who has 40 acres, about 25 of which are in orchards. With the habitual thoroughness of the race he has an excellent orchard, but he hires six men the year through.

Mr. REEDER. On how many acres?

Mr. McCONNELL. On 40 acres.

Mr. REEDER. That is what I thought from what I knew of the country.

Mr. VAN DUZER. I spoke about whether the family could take care of it. I suppose that would depend on whether they came from Utah or Kansas?

Mr. REEDER. That would make a difference, I suppose; but I was referring to the ordinary family where they have one or two possibly as helpers.

Mr. McCONNELL. Yes, sir; they would have to have help at the busy season to do the work.

Mr. BELL. Out in California we raise lots of fruit. I do not know that in California it takes two men and a lot of hired men to take care of 7 acres of trees. At the rate of 144 trees to the acre, that would be only about a thousand trees.

Mr. REEDER. It certainly does in Canyon City. I do not know what they have there. They have small fruits, of course, a good deal, and probably some vegetables.

Mr. BELL. Oh, if they get into the vegetables and berries and things of that kind, I can see how more help would be required.

(Thereupon the committee adjourned until Monday, January 16, 1905, at 10 o'clock a. m.)

COMMITTEE ON IRRIGATION OF ARID LANDS,
HOUSE OF REPRESENTATIVES,
Monday, January 16, 1905.

The committee met at 10.30 o'clock a. m., Hon. Frank W. Mondell in the chair.

The CHAIRMAN. The special order for the day is the bill (H. R. 17250) introduced by Mr. Gillett, of California. Some of the gentlemen of the reclamation service are here ready to answer any questions which any member of the committee may desire to ask them in regard to the measure. I suggest that if any member of the committee has any questions to ask or desires any further hearing that we have it now and then go into executive session for the consideration of the bill.

STATEMENT OF MR. J. B. LIPPINCOTT, SUPERVISING ENGINEER, GEOLOGICAL SURVEY—Continued.

Mr. BELL. Is there any question of the right of the Reclamation Service under the terms of the act creating it to reclaim these peat lands and the beds of these lakes? Suppose that question were raised, you might probably come in conflict with some private interests which might want to raise some technicality to obstruct your work. Have you looked into that subject in connection with the reclamation of arid lands?

Mr. LIPPINCOTT. The position of the Department, as I understand it, in that connection is this: That we have no right to reclaim swamp or overflowed lands by drainage as a separate and independent piece of work, but if in carrying out a general irrigation project it becomes necessary as an incident of that work to drain lands and build levees, as we are doing on the lower Colorado, that it can be done—as an incident of a general irrigation enterprise.

Mr. BELL. One feature of the work in the Klamath region was to construct a tunnel some 1,500 feet in length, by which you would drain the waters in the lower Klamath Lake?

Mr. LIPPINCOTT. Yes, sir.

Mr. BELL. Does that tunnel serve any purpose in reclaiming the arid lands?

Mr. LIPPINCOTT. No, sir; except in this way: There are a great many different features or different lines of work that can be carried out there, and this tunnel is one of the things that can be done toward the general development of that section and the general construction of the Klamath project.

The CHAIRMAN. What is the area which you estimate would be brought under reclamation by this project, if carried out?

Mr. LIPPINCOTT. As near as we can tell, Mr. Chairman, there are about 300,000 acres irrigable from the upper Klamath Lake and the proposed Lost River reservoirs. In addition, there are about 90,000 acres in the Klamath Indian Reservation that ultimately would be brought into a harmonious reclamation project.

The CHAIRMAN. Do these 300,000 acres include the lake beds?

Mr. LIPPINCOTT. Yes, sir. We can not say that we can completely dry up those lakes, but it is probable we can uncover 50,000 acres of Tule or Rhett Lake and about half of Little Klamath Lake.

The CHAIRMAN. Then the 300,000 acres would include that amount of the lake-bed lands. Of the lands that would be reclaimed under your project, other than drained lands, how large a percentage would be public lands?

Mr. LIPPINCOTT. I do not know absolutely, Mr. Chairman, but including the lake-bed lands we think that almost half of the lands that can be reclaimed will be public lands, and that would mean 150,000 acres.

The CHAIRMAN. Including 60,000 or 70,000 acres of lake-bed lands?

Mr. LIPPINCOTT. Yes, sir; that is it.

Mr. BELL. Do you not intend to drain Rhett Lake or Tule Lake; that is, 25,000 acres in the lake and some 40,000 acres of peat lands?

Mr. LIPPINCOTT. In Tule or Rhett Lake there are 100,000 acres that have an average depth of about 12 feet, and in this estimate we have only considered 50,000 acres as being uncovered.

Mr. WILLIAMSON. Is there not quite a lot of that land in private ownership that has no other prospect of irrigation other than the prospect it has through the proposed Government work?

Mr. LIPPINCOTT. Yes, sir.

Mr. WILLIAMSON. Have you any idea how large a proportion of the land in private ownership is in that condition?

Mr. LIPPINCOTT. We have not gone into the matter of looking up the titles of those lands in detail, and I can not give absolute figures. The figures that have been already given are the best that I can give—that outside of the lake-bed lands there are 70,000 acres of land that can be reclaimed. I have a table giving the details of these reclaimable areas, which I can read if you so desire.

Mr. BELL. Can you not insert the table in the record? Just leave it with the stenographer.

Mr. LIPPINCOTT. Yes; very well.

KLAMATH PROJECT.

The following is an estimate of the gross irrigable areas, in acres:

Irrigable from Clear Lake and Horsefly reservoirs:		
Langell Valley	12,000	
Poe Valley	10,000	
Swan Valley	30,000	
Alkali Valley	20,000	
		72,000
Irrigable from Klamath River:		
Between Klamath and Merrill	60,000	
From Merrill to Carrs	10,000	
Bed of Tule Lake	50,000	
Bed of Lower Klamath Lake	20,000	
		140,000
Butte Valley, irrigable by pumping		100,000
Total		312,000

The CHAIRMAN. They are separate bodies, disconnected bodies, are they?

Mr. LIPPINCOTT. Yes, sir; except in the case of Butte Valley, in California, where there is quite a large body of Government land; I believe in the neighborhood of 15,000 acres.

The CHAIRMAN. In making your estimate of the amount of public lands you estimate all the land within the sweep of your ditch lines, do you?

Mr. LIPPINCOTT. Yes, sir; practically.

The CHAIRMAN. Of course, some of those lands would probably be irreclaimable, for some reason or other?

Mr. LIPPINCOTT. It is possible; yes, sir.

The CHAIRMAN. From the fact that so large a portion of the lands in the vicinity have passed into private ownership, the inference would be that some of those lands still remaining public lands were rough, broken, or inferior?

Mr. LIPPINCOTT. Yes, sir; in part; but very largely they remain public lands because they are now hopelessly distant from existing water supplies.

Mr. BELL. Suppose in carrying out this project you should uncover, we will say, in round numbers, 100,000 acres of swamp lands, and the best of those lands would be under cultivation, can you make those lands bear their proportion of the entire expense?

Mr. LIPPINCOTT. You are talking about the States swamp and overflow acts?

Mr. BELL. Yes, sir.

Mr. LIPPINCOTT. The owners, as far as we have seen them, and we have seen a good many of them, are supporting this proposition of the Government building the Klamath project, and have expressed a willingness to accept our usual practice with reference to the subdivision of private lands.

The CHAIRMAN. You are speaking now of lands outside (above) the meander lines of the lakes, which have passed into private ownership throughout the States?

Mr. LIPPINCOTT. Yes, sir.

Mr. BELL. Of course those lands that are outside (below) of the meander lines you expect, however, to be ceded to the United States and then come under the provisions of the reclamation act?

Mr. LIPPINCOTT. Yes, sir.

The CHAIRMAN. Mr. Bien told us the other day, as I recall his answer to my question, that it would probably take a court decision to determine who owned the submerged lands; that is, the lands within the meander line, the lands clearly not public lands of the United States. Have you any opinion on that subject?

Mr. LIPPINCOTT. Yes, sir. Mr. Bien went over this project in the field with me in November and he took the position then that that was the condition just as you have stated it, and that in order to clear title to those lands it would be necessary to get a cession of any claim that the State of Oregon or the State of California might have to those lake-bed lands. Consequently the legislatures of both those States are now passing bills or, at least, considering bills for that purpose. I have a telegram from Governor Pardee this morning which reads:

Klamath bill introduced in both houses of legislature and in all probability will pass. Hope Congress will pass bill, as it is very important to welfare of California and Oregon.

That would clear up any claim that the State might have to the lake beds.

With reference to any right that any riparian owner might have to those lands, where the riparian land is in private ownership we propose not to begin the lowering or draining of those lakes until we obtain a release from the riparian owner of any claim that he might have beyond the meander lines. It is not necessary to begin this drainage in the early stages of the construction of this project and we believe that that adjustment could be made.

The CHAIRMAN. Of course you have no means of knowing whether the riparian owners would agree to surrender any claims they might have?

Mr. LIPPINCOTT. No, sir; except in this way: The large portion of these marginal lands is swamp lands that can not be reclaimed unless there is a general lowering of the water level, and it is very much to the interest of those people to reclaim their own lands, and it would appear that it is to the interest of those parties to aid any such work.

The CHAIRMAN. Your idea is that they would profit sufficiently by the drainage of the riparian lands that are now overflowed that they might be willing to surrender any claims which they would have to the lands beyond the meander lines?

Mr. LIPPINCOTT. Yes, sir; that is the idea.

Mr. TIRRELL. In view of the fact that there is such a large quantity of the lands held by private ownership, I would like to ascertain whether the Department of its own volition took up this matter of the reclamation of the lands or whether this was a movement by the private owners to throw more land of that character into the market and also, perhaps, to purchase their own interests?

Mr. LIPPINCOTT. I am very glad of an opportunity to answer that question. Immediately after the passage of the reclamation act and before that I had been examining opportunities in California for the construction of reclamation projects, and we took up one project after another in California, one on Kings River and one on Cache Creek in central California, and in each one of those instances there was such a complication of private rights and existing canal systems that we had to abandon those projects at least for the present, and we were practically driven out of the more permanently settled portions of California in our efforts to find a locality where the reclamation act could be applied for the reclamation of some public lands, and in those investigations this Klamath project was found.

The people of the Klamath Basin, however, sent representatives to an irrigation congress at Portland in the fall of 1902 and particularly requested us to come into that district. We went there first in the fall of 1903, and the result of our investigations was such as to show a remarkable physical opportunity for reclaiming lands at a relatively low cost, and as soon as our presence became known in that country a public movement was at once started—encouraged by our presence—and the people have organized into associations of various kinds to engineer and push this matter, and they have sent in petitions to that effect. So, it is a combination between discovery on our part and the requests of the people.

The CHAIRMAN. How much land is irrigated by the Ankeny ditch?

Mr. LIPPINCOTT. About 5,000 acres.

The CHAIRMAN. Is there any more land under the Ankeny ditch that might be irrigated?

Mr. LIPPINCOTT. Yes, sir.

The CHAIRMAN. Then, why is not more land irrigated?

Mr. LIPPINCOTT. The ditch is carrying the full capacity of water

The CHAIRMAN. And would have to be enlarged? That is what you old us the other day. This other company that you spoke of began operations there, when?

Mr. LIPPINCOTT. You mean the new company?

The CHAIRMAN. Yes, sir.

Mr. LIPPINCOTT. There is another old ditch there.

The CHAIRMAN. I refer to the company that is proposing rather nore extensive works there paralleling, but higher than the Ankeny canal. When did they begin operations?

Mr. LIPPINCOTT. To the best of my knowledge and belief, it was about the 1st of January, 1904.

The CHAIRMAN. Have they spent any considerable amount of noney in construction?

Mr. LIPPINCOTT. They have spent something materially less than $50,000 on a tunnel and the starting of some canal construction. That s, however, merely an opinion, not based on any estimate I have nade, and is subject to revision.

The CHAIRMAN. Their work is approximately along the line that you would follow in your tunnel, diverting the water from Klamath Lake?

Mr. LIPPINCOTT. Yes, sir.

Mr. REEDER. Is there any object in that 1,500-foot canal except to drain the lake? Is the water to be used for any purpose?

Mr. LIPPINCOTT. We expect to use the water power that can be developed in the Klamath River below the lake region, but the purpose of the tunnel I speak of is primarily for drainage.

Mr. REEDER. In case you find that you can not get title to those ands under the water in the shape you wish, that will just simply nake that much less land and that much less expense?

Mr. LIPPINCOTT. Yes, sir.

Mr. REEDER. What becomes of this water that passes through Klamath Lake; does it go to Klamath River?

Mr. LIPPINCOTT. It goes right down the Klamath River into the sea.

Mr. BELL. I move that the committee proceed to the consideration of executive business.

Thereupon the committee proceeded to the consideration of execuive business.

COMMITTEE ON IRRIGATION OF ARID LANDS,
HOUSE OF REPRESENTATIVES.
Washington, D. C., January 17, 1905.

The committee met this day at 11 o'clock a. m., Hon. Frank W. Mondell, chairman, presiding.

The CHAIRMAN. Gentlemen, this meeting was called for the purpose of hearing further from the officers of the reclamation service. While we lack one of having a quorum at this moment, perhaps it would be just as well for us to go on with the hearing, as I have no no doubt that other members of the committee will drop in shortly.

Mr. Newell, what gentlemen of your force would you like to have address the committee this morning?

Mr. NEWELL. There are here, Mr. Chairman, several gentlemen from the West—Mr. Louis C. Hill, in charge of the work in Arizona who has under his charge one of the largest pieces of work actually under construction; Mr. Taylor, of Nevada, who has in charge the work in that State, where the most money has thus far been expended; Mr. Means, who is making a study of farm units and the classification of soils; Mr. Storrs, our electrical expert, and Mr. Noble, in charge of the work in the State of Washington. We have also here Mr. ———, in charge of the work in Montana, and Mr. C. J. Blanchard, our statistician. Several of these gentlemen must go back, particularly Mr. Hill, inasmuch as bids must be opened in connection with a large dam near Roosevelt, Ariz., and I suggest that possibly for a short time Mr. Hill might address you.

The CHAIRMAN. Very well; we will hear from Mr. Hill.

STATEMENT OF MR. LOUIS C. HILL, ASSISTANT ENGINEER IN ARIZONA.

Mr. HILL. Mr. Chairman and gentlemen, the Salt River project in Arizona is intended to irrigate about 200,000 acres of land in the neighborhood of Phoenix. This land is at the present time mostly held in private ownership, but the supply of water is erratic, and sometimes while they have enought water to raise their crops for a number of years, then for some years following there will be barely enough water to support the trees, let alone the crops.

The work there consists primarily of a large dam, at a point about 70 miles above Phoenix, across the Salt River. It is intended to impound 1,800,000 pounds of water. It will be about 200 feet long on the bottom and 270 feet high from the bottom to the top. It will raise the water in the river about 210 feet.

The CHAIRMAN. That is, that much from the foundation?

Mr. HILL. Yes; from the foundation to the top of the dam.

Mr. REEDER. Please give me again the amount that dam will impound.

Mr. HILL. About 1,800,000 pound-feet.

Mr. REEDER. What section of land will that irrigate?

Mr. HILL. The use of water in that section is about 5 feet per acre, but, of course, we have almost continuous crops there, and the temperature is so high that they hardly have to stop irrigating or raising crops at any season of the year.

Mr. REEDER. You say 5 acre-feet to the acre?

Mr. HILL. Yes.

The CHAIRMAN. Inasmuch as the water you impound is only used to supplement the waning flow of the stream, the amount of land that can be irrigated by utilizing this dam is much larger than 1,800,000 feet, is it not?

Mr. HILL. It is not, because the total flow of the stream is somewhat less than 1,100,000 feet at the average. Of course, sometimes floods come down the channel. One came down that would fill the whole reservoir in four days. Last year the water dropped 42 second-feet, about a quarter as much as would be required to make up the evaporation alone.

Mr. COOPER. The evaporation would be very great there?

Mr. HILL. Yes, sir.

ow the Verde River enters the Salt River about 45 miles below the ı. During the season when the floods occur in the Verde River no ds are allowed to pass Salt River dam. During the dry season ıgh water must be allowed to flow from the Salt River dam to sup- this irrigation. In addition to the supply from the reservoir, e is a splendid supply of water through that valley of an unde- nined amount, but it is a very large supply. It is hoped that at t 50,000 acres additional may be irrigated by pumping from this erground supply. At the present time there is quite a number of ısands of acres that are irrigated by private lands.

Ir. REEDER. What power would be used to pump that out?

Ir. HILL. We are at the present time constructing a canal, which ell along toward completion at the dam, starting above the reser- line and bringing the water down before the dam, and confining ıto the canyon below, about 200 feet. This canal will carry the rage flow of the river, and will generate an average somewhere ınd 5,500 gross horsepower. This will enable us to protect in the ey somewhere in the neighborhood of 40,000 acres, provided we do have to carry it too far.

During a part of the year, however, this canal can not afford us so h power. During this season of the year, however, a considerable ount of water will have to be taken from the reservoir, and all the er is passed through the turbine water wheel, and it is used to sup- nent the power derived from the power canal.

he water derived from this power canal must also be used in the struction of the dam and in running the cement plant, which is ost completed, I am glad to say, and which is expected to begin ning this month. This cement plant will be sufficient in capacity uild the dam.

he lowest price that we are able to obtain cement for, delivered at dam, was about twice as great as the price of manufacturing it e, if we had the opportunity of actually manufacturing—about e the entire cost of installing the cement plant. This is entirely to the freight and wagon hauls. It is 40 miles to the nearest rail- l station in one direction and 60 miles to the nearest railroad sta- ı in another direction. So, it being thus so remote from any source upply, we have practically had to make almost everything we use there ourselves. We made bricks and burned lime, and we make ent and saw lumber. We used a million feet of lumber and ed it, and we have had to build about 80 miles of wagon road. re is a wagon road that runs from Mesa to Roosevelt, a distance 30 miles. The towns near there contributed largely to the build- of this road. The roads were necessary to enable us to get sup- s in to this terminal line.

Ir. BELL. If you had bought your cement on the outside, what ıld it have cost at the dam per barrel?

Ir. HILL. The cheapest price delivered at the dam was $4.80 a bar- and we use 200,000 barrels.

Ir. VAN DUZER. How far would you have to haul that cement?

Ir. HILL. Forty miles, the shortest distance. The cheapest bid we ived was from Portland, Colo. That had to go from Portland, o., to Deming, N. Mex., and from Deming on another line to Mari- a or Tempe, and the combined freight rates, added to the wagon ght, which was itself about $1.50 a barrel, ran the cost up to $4.80

per barrel. That was the cheapest rate we could get for the 200,000 barrels we had to use.

Mr. BELL. Do you find all the materials for cement making there?

Mr. NEWELL. The cement mill is so constructed—in fact the site was entirely excavated in the line which formed the largest constituent of the cement. The soil that had to be excavated was almost perfectly adapted for the manufacture of cement. There are very large hills of clay within 3 miles. We have got three other deposits of clay besides that within a mile.

Mr. BELL. Do you think you will be able to make as good an article as the Portland cement?

Mr. HILL. It is Portland cement.

Mr. REEDER. This road you are constructing for the purpose of getting material in there—will that be useful after the dam is built, for any purpose?

Mr. HILL. Yes; when we took up the question of constructing this road I had a good many conversations with the general freight agents of some of the competing lines; and, going to Globe, which was the other point, we had to complete a road about 20 miles to get there. That was a branch road and owned independently, and they consequently charged anything they pleased. To get most of our supplies in we had to come over the Southern Pacific and over this Gila Valley, Globe and Northern. The freight rates on everything were very high. Coal, for example, in the mines of New Mexico worth about $1.25 a ton, would be worth at Globe $11 a ton when delivered to us.

Mr. VAN DUZER. What do you say you got it for at the mines?

Mr. HILL. For $1.25. And cement, until this adjustment of this very large plant, all the cement in the market cost there, in carload lots, $9 a barrel. The railroads, of course, controlled the situation entirely. When we came to build this other road they told me if we never hauled a pound of freight over the road it would be worth our while to build it, because immediately upon the building of the road they lowered the freight rate to Globe and to Mesa.

Mr. VAN DUZER. The railroads then reduced the freight rates?

Mr. HILL. Yes; but not until after we built the road.

The CHAIRMAN. How much did you expend on that road?

Mr. HILL. About $75,000.

Mr. VAN DUZER. How many miles?

Mr. HILL. Sixty miles. That road is under the control of the Government for the first 40 miles. The second part of it will be paid for by the county.

Mr. BELL. Did they reduce the freight rates generally to the public?

Mr. HILL. Yes.

Mr. VAN DUZER. That is, over those 40 miles?

Mr. HILL. Yes, sir; by building that road the freight rates to the public were reduced at Mesa.

Mr. VAN DUZER. Has not your experience down there been that freight rates in that section of country have been a great drawback to development of any kind?

Mr. HILL. Indeed it is. The cost of most of our materials that are brought in there, even the low-priced materials, is very much increased by the freight rates. The freight alone costs about 30 per cent of the cost price. Little bags of salt, for instance, about that

high [indicating], for which you pay 5 or 10 cents almost anywhere, they pay 25 cents for there. The freight rate, of course, adds about a cent and a half per pound. The freight rates are what make a project of that kind so expensive. If it had not been for the fact that so many of the materials were on the ground it might not have been possible to build it. The lumber alone, by our being able to saw it where we did, enabled us to save about one-half.

Mr. VAN DUZER. What does it cost you now?

Mr. HILL. It costs us $27 a thousand.

Mr. VAN DUZER. What would it cost you otherwise?

Mr. HILL. About $60 a thousand.

Mr. VAN DUZER. Practically, if you had not been able to take advantage of nature there, and had to go outside of the State to other sections of the country for materials, and so forth, to construct that reservoir, the prohibitive freight rates would have made the thing practically impossible, would it not?

Mr. HILL. Yes. And in addition to that, there was an excessive wagon haul that can not be hauled for less than 27 cents a mile.

The water is all carried down and will be delivered to the land in the immediate vicinity of Mesa, Phoenix, and Tempe. That is as fine land for irrigation as I ever saw anywhere, and the crops that can be raised there can be of great variety. The climate is such that they can raise oranges and bananas and dates. Figs do not do very well, but alfalfa and grains of various kinds can be raised readily, and almost all the staple crops.

One of the difficulties they have had so far in raising large oranges is the uncertainty of obtaining water. Of course the orange orchards down there during the hot weather feel the lack of water more than any other crop. A considerable acreage was put into cantaloupes this season, for which they obtained a very good price. There has been uncertainty, of course, in regard to water. There have been water-using associations formed there which will practically cover all the land which can be irrigated by this reservoir and this distributing system. Those associations have been practically signed up by members covering all the lands that can be covered by this reservoir and irrigated by this system.

Mr. COOPER. There are a number of private projects there for supplying water, are there not?

Mr. HILL. Oh, all these canals are owned either by private corporations or by individuals.

Mr. COOPER. Does that project interfere with the rights of these people—those rights that they have already acquired?

Mr. HILL. No, sir; the people who own the water are people who are members of this association. According to the decisions of the Arizona courts, the canals are simply public carriers. The water is appurtenant to the land, and the people own stock in the canal everywhere.

Mr. COOPER. I learned several years ago that there were a number of people around there who had interest in supplying the water around Phoenix—people from my section of country. My impression was that they supplied water for so much per acre, and that they were simply suppliers of water for a compensation, and it occurred to me that they might have some vested rights there that the Government would interfere with.

Mr. HILL. The people own the water. The water is all appropriated. But during the flood season large quantities go to waste. Last year there went by Phoenix as much water as would give at least two irrigations all over the country, whereas they get perhaps a part of one.

Mr. COOPER. What system do you use?

Mr. HILL. The flowing system. They are using the flowing system. They divide the land up and allow a large quantity of water to come in at one end and flow over the land, which is cut up in tracts.

Mr. VAN DUZER. How large are those tracts?

Mr. HILL. Of course that varies. In some places they are about half a mile long to 100 feet wide.

Mr. BELL. Do you check it up there in small blocks?

Mr. HILL. No, sir; they do not have to do that. The slope of the land is just about right. If they have enough water to start with that system will allow the water to flow, and with a very good system of irrigation.

Mr. COOPER. How about the quality of fruit and vegetables raised there?

Mr. HILL. The quality of the oranges, for example, is very good indeed, and their grape fruit is very good. Figs they have not raised in any quantity, so far as I know. They raise a few nuts, but the difficulty has been so great a lack of water that they have lost lots of crops.

Mr. VAN DUZER. What is the chief export product there, or crop?

Mr. HILL. Perhaps alfalfa is as much raised as anything—alfalfa, and then they feed it to cattle. Then they raise a good deal of fruit there. As soon as they are sure of water they can be sure of fruit. The large orchards that have failed there have failed on account of lack of water.

Mr. VAN DUZER. Your fruit season is earlier there than anywhere else?

Mr. HILL. Yes. At Yuma, perhaps, fruit might mature a little earlier. They receive a high price for their oranges there on account of that fact.

Mr. COOPER. How about cantaloupes and growing vegetables?

Mr. HILL. They raised a great many cantaloupes last year, and obtained very good prices. It was a very good crop, because a good many small dealers would hire about 10 acres and be able to pay $25 an acre rental and still make about $100 an acre profit on the land; and they were doing very well.

Mr. COOPER. I should think so.

Mr. HILL. Yes.

The CHAIRMAN. Do you use your power canal yet?

Mr. HILL. We will in two or three months.

The CHAIRMAN. When will you open bids for the dam?

Mr. HILL. They will be opened on the 20th of next February. The work will begin in ninety days under contract.

Mr. BELL. When do you estimate the dam will be completed under the contract?

Mr. HILL. According to the specifications we do not require any definite date. But in comparing bids we allowed $250 a day as the value of each day of early completion. That is, if one man bid thirty

days less than another his bid would be worth $7,500 more than the other. It is worth at least that to the valley; possibly more.

Mr. BELL. You do not know, of course, then, until you open your contracts?

Mr. HILL. No. We want to build the upper part in colder weather than the lower part, because after the inception of the dam, if the upper part is built in hot weather, the stone and other materials will expand; and consequently we want to build them when the temperature is more nearly the average temperature.

Mr. COOPER. How long will it be until you get to the dam?

Mr. HILL. About two years. We intend to allow the water to fill up the dam, and as soon as there is enough in it to make it worth while we will begin to utilize it. That is one of the reasons why we want to run the 150-foot level as soon as possible. The rest can wait, for it does not count so much.

The CHAIRMAN. Are there any further questions that members care to ask of Mr. Hill?

Mr. COOPER. About what is the population of Phoenix?

Mr. HILL. Phoenix has about 10,000 population. Mesa has about 1,000, and in the neighborhood around there are about 20,000 or 30,000 people.

Mr. BELL. What is the farm unit there?

Mr. HILL. One hundred and sixty acres is the farm unit there. This is one of the first projects which they subdivided.

Mr. BELL. It is a little high?

Mr. HILL. Yes.

The CHAIRMAN. Mr. Newell, what gentleman shall we hear from next?

Mr. NEWELL. I would suggest Mr. Taylor. He has similar work in Nevada.

STATEMENT OF MR. L. H. TAYLOR, SUPERVISING ENGINEER IN CHARGE OF NEVADA WORKS.

Mr. TAYLOR. Mr. Chairman and gentlemen, the Truckee-Carson project, upon which the United States Reclamation Service is now engaged in construction, contemplates the use of water from the Truckee and Carson rivers for the irrigation, ultimately, of from 350,000 to 375,000 acres of land. The portion of the work that is now under way will, when completed, supply water to approximately 200,000 acres of land.

These rivers have their sources on the eastern slope of the Sierra Nevada Mountains, in the State of California, flow northward for some distance, then turn eastward and northeastward and cross the State line into Nevada; and then flow, the Truckee River into Pyramid and Winnemucca lakes and the Carson River into Carson Lake and Carson Sink. The waters evaporate or sink there.

The preliminary examination of those streams, with a view to determining approximately the water supplies and what might be done with them, was really instituted before the passage of the reclamation act; and when that act was passed, on June 17, 1902, we had already collected a good deal of information that enabled us to get construction started earlier than in most of the States.

The Department of the Interior, I believe, has allotted about $2,740,000 for the initial part of the work. That will enable us to place water upon about 200,000 acres of land, and probably by the end of the present year the payments to be made by the settlers on these lands for the irrigation work will begin to return that fund to the Government, and within three years there should be a sum coming in annually which will enable us to proceed with the construction of other portions of the work, so that the project, as a whole, will, after an expenditure of the initial allotment from the reclamation fund, carry itself on to completion, and return the original allotment.

The preliminary surveys for the first or main canal line, which extends from the Truckee River a distance of 31 miles to the Carson River, where the waters will mingle, were begun in December, 1902, and in April, 1903, the definite location was completed. Plans and specifications were drawn up in May, and advertisements were published in the various papers asking for proposals for the construction of the works. Bids were opened in July, and on the 11th of September, 1903, the first ground was broken, that being the first actual construction work to be undertaken by the Federal Government under the reclamation act.

This canal, costing approximately a million dollars, is now approaching completion, and in the meantime we have begun construction of the main distributing system and some of the minor laterals, so that we will be able to supply water, we anticipate, to from 20,000 to 30,000 acres of public land and from 15,000 to 20,000 acres of private land in April next.

In the Carson Sink Valley, where these 200,000 acres of land are situated, between 50,000 and 60,000 acres are in private ownership, the remainder being public land. Of the 50,000 or 60,000 acres, in the aggregate perhaps 8,000 or 10,000 acres belong to the old Central Pacific land grant and are still owned by that company.

The water is supplied to private lands not now under cultivation on the same terms that it is supplied to public lands. There were some 10,000 or 12,000 acres under irrigation in the Carson Sink country when we began operations there, and the owners of those lands had vested rights in the waters of the Carson River, which of course can not be disturbed.

Thus far I can not state the exact sum that has been expended in connection with the construction work there, but it is a trifle over a million dollars, so that we have expended perhaps more money than any other district has up to date.

In regard to the settlement of the public lands, our experience is rather the reverse of what some people had apparently anticipated. Our greatest difficulty is to prevent the people from coming on there prematurely and entering and settling upon land which the waters would not reach for two or three years, perhaps, and where there is nothing whatever that they can do upon the land to make a living in the meantime. Some people have done that anyway, regardless of our efforts at discouragement.

In connection with the irrigation works there we have a number of storage reservoirs, the largest of those we expect to utilize being Lake Tahoe, where we will control the outflow from that lake and regulate it, storing a very considerable portion of the flood water that would otherwise go to waste.

Mr. VAN DUZER. What can be stored up there? What is the capacity?

Mr. TAYLOR. The capacity within the limit in which we propose to regulate it, between the extreme low-water limit and the extreme high-water line that has been observed in the past, will be about 750,000 acre-feet. That, however, is in excess of the normal water supply derivable from that watershed, and our estimates of the possibilities there are based upon our being able to draw off 200,000 acre-feet annually in any season from that reservoir.

Mr. VAN DUZER. That would not interfere with the regular flow of Truckee River? That would not be interfered with?

Mr. TAYLOR. No; the Truckee River, the regular flow of the Truckee River, would not be interfered with, but it will be regulated to a considerable extent. There are situated on that river above the town of Reno, and just over the California-Nevada boundary line, in the State of California, two institutions that use the water of the Truckee River for power purposes quite largely. We do not propose to interfere with them, but rather to help out their water supply by the regulation of the river, making its flow more uniform, instead of violently fluctuating, as it is at the present time. That water, flowing down the Truckee River to a point some 25 miles east of Reno, we pick up in the canal, now nearly completed, and convey it to the Carson River.

At this point we constructed a dam and create a reservoir, which will have, in round numbers, a capacity of 300,000 acre-feet. We store the water that will not be used in the nonirrigating season in this reservoir on the Carson River, and consequently are able to make use of it for irrigation in the irrigating season. We also have three other reservoirs in contemplation on Carson River.

Mr. VAN DUZER. I would like to ask a question. Will you tell the committee how much of the land will be reclaimed by the project of Lake Tahoe—those waters alone?

Mr. TAYLOR. By controlling those waters alone we can irrigate not less than 150,000 acres of land, using it to supplement the regular flow of the Carson and Truckee rivers in the latter part of the season. But we will build on Carson River, a short distance above the reservoir that we propose to utilize for the purpose of storing the Truckee water, another reservoir, which will enable us to regulate the flow of Carson River in its lower stretches, so that we will have plenty of stored water from which to supply this land.

Of course the duty of water there is quite different from the duty of water in southern Arizona, in the torrid climate they have there, and largely on account of the heat and largely on account of the growing season, our crop season in Nevada not being much more than half as long as the crop season in Arizona.

Mr. VAN DUZER. The trouble in Arizona is to keep things from growing. [Laughter.]

Mr. COOPER. What percentage of evaporation of water there do you calculate?

Mr. TAYLOR. The evaporation direct, as we have measured it so far, from a body of water in a district where we expect to carry on irrigation, will be in the neighborhood of 4 feet in depth; from 48 to 52 inches.

Mr. COOPER. What percentage would that be of the whole water supply there?

Mr. TAYLOR. You might say it would be the whole water supply; there will be no other way of escape. It must evaporate.

Mr. COOPER. I mean what would be evaporated by the heat and pass off, so that you would not utilize it and not get any benefit from it?

Mr. TAYLOR. Exactly; the evaporation from our reservoir and from the canal and distribution ditches will probably amount to 20 to 30 per cent of the water supply.

Mr. COOPER. That is what I wanted. It would be twice that down in the Phoenix country

Mr. HILL. The evaporation in the Phoenix country is 8 or 9 feet.

Mr. COOPER. How much would it take per day to the acre?

Mr. TAYLOR. It would take from 2 to 3 acre-feet.

Mr. COOPER. That is one of the great questions—the control of that evaporation.

Mr. REEDER. But they figure that out when they talk about 5 feet per acre-foot of water. Up in Nevada it does not take more than 2 or 3?

Mr. TAYLOR. There are some places there where they are getting good results when they apply about 1½ feet.

Mr. COOPER. If your crop season is short, you do not need so much for irrigation there?

Mr. TAYLOR. No, sir; we use it for a much shorter time. Our rainfall ranges from 4 to 7 inches—our mean annual rainfall.

Mr. COOPER. Your sources of supply are from various sections?

Mr. TAYLOR. Yes; the Sierra Nevadas are forest-clad mountain ranges, where the precipitation is very heavy.

Mr. COOPER. It will be necessary to preserve these forests in order to protect the water supply?

Mr. TAYLOR. Yes; that is rather a vital matter out there. The precipitation up there will range from about 25 to 70 inches per annum. It then falls off very rapidly as you go eastward to the Great Basin, over in the State of Nevada.

The CHAIRMAN. If there is nothing more——

Mr. BELL. All that country is in forest reserves now?

Mr. TAYLOR. A considerable portion of it. That is, part of the headwaters of the Truckee River are embraced in the Tahoe Forest Reserve, and of the Carson in the Stanislaus Forest Reserve. The rest is withdrawn temporarily.

Mr. VAN DUZER. I would be very glad to have you explain to the committee something of the condition of the Walker River project, if it is far enough along.

Mr. TAYLOR. Nothing has been done there, except a little preliminary reconnoissance, so far. The Walker River, of course is a stream lying southward of the Carson River, having its sources also in the Sierra Nevadas, a little to the south of the Carson River. We have made simply some preliminary explorations of it, and there is nothing really to be said about it yet.

The CHAIRMAN. Is there anything more, gentlemen? If not, Mr. Newell, we will hear from the next gentleman.

Mr. NEWELL. Mr. Chairman, I would like to ask, in this connection, that Mr. Means speak somewhat on his work on soil classifica-

and the character of soils, particularly in two large projects. contracts let under his supervision have turned out well. We been very fortunate heretofore in getting contractors, and the : has been executed in such a way as to show that the contractors not made much money out of the work, and in some cases they lost heavily. The contracts have been let in some cases at less our estimates and have turned out very well for the preliminary :.

r. VAN DUZER. Who is the gentleman who has charge of all your sportation matters? Do you have any one particular depart- : for that?

r. NEWELL. Yes; Mr. Perkins has been looking after almost all ers relating to freight rates and transportation of laborers, and as been making the contracts with railroads to secure the best ; we can. As a rule, we have secured 50 per cent of the nominal ;—50 per cent of the commercial rates. There are a good many outations entering into that, because the Government already from land-grant and bonded railroads free hauls, and charges, ot to be paid in cash, are to be credited on the old debts. This es it extremely complicated to figure out equitable rates.

r. VAN DUZER. Some considerable reduction on the part of the oads has been absolutely essential to the success of these large ertakings?

r. NEWELL. Yes. The beneficent effects of our action in regard ie cement plant, for example, have been felt all along the line 1 it became known to the country that we would not pay $9 a el for cement. We would begin our work first, and after we ally began the construction of those works the moral effect upon ransportation interests has been very great. We have been able o to them and say generally, "We want these concessions," and act has been borne in on them that we have an alternative which an utilize if we can not get reasonable rates from them.

r. VAN DUZER. Have you ever made any investigation in regard ie possibilities of freight rates after these projects are completed? or myself, I think the question of reclamation of arid lands is ly allied to the question of freight rates. In certain sections of rid West, unless we eventually get some relief from freight rates, vill be in a position where it may be difficult for a man after he raised something to market it outside the demand of local con- ption.

ie great question in the future with regard to the reclamation of is going to be, where the local consumption in all these States not be very much, that we will have to hunt for markets. If you consider the work and scope of this reclamation act you will find it will be of a nature sufficient to supply great sections of the d with what we raise, so that the second problem will be the ques- of our markets. And how are we to get into markets unless we favorable rates? I am taking a great deal of interest in Presi- Roosevelt's strong and commendable stand on the railroad ques- , and as a Democrat my purpose is to give him the strongest sup- I can. I think it is one of the great questions of the country allied closely to this reclamation work. I did not know if it had followed by you men of the Reclamation Service.

r. NEWELL. That question is so far reaching that we feel we could

not go into it beyond the mere prospect that it is probable that the land will produce such a crop as will represent the cost of the work. The first work has been to build those works cheaply and economically and at a cost which would bring the commendation of the Congress and of the public in consequence of the fact that we were handling this thing carefully. Whether the crops will refund the cost or not, we have studied that from the practical side somewhat and considered this fact: That the crops are such that they can be reduced to a minimum for transportation. For instance, alfalfa can be put into beef, and root crops can be put into sugar, and so on. Beyond those simple considerations we must trust to general commercial conditions. We can not anticipate very far.

The CHAIRMAN. The committee will now hear from Mr. Means.

STATEMENT OF MR. THOMAS H. MEANS, IN CHARGE OF SOILS.

Mr. MEANS. The provisions of the reclamation act required that the Secretary of the Interior should subdivide the Government land into farm units of sufficient size to support a family. It becomes necessary, therefore, that we examine such soils as we propose to irrigate in order to determine whether they are worth irrigating at all, and whether a man irrigating such soil can return to the Government the cost of irrigation.

And again, we aim to determine the amount required for the support of a family, which varies with the climate and the elevation, as also with the soil. A man, for instance, can raise sufficient on 40 acres in southern Arizona to support a family in food and lay quite a little aside. On the other hand, in the higher parts of Montana and Washington, where the season is short and the class of products is not the most valuable, a larger acreage per family is required.

Mr. WILLIAMSON. Have you ever thought that that would be an excellent settled basis on which to rear all our land laws—the amount it takes to support a family, and not an arbitrary area?

Mr. MEANS. I have, particularly as to grazing lands.

Mr. WILLIAMSON. I am much interested in that subject myself. You will pardon me for interrupting.

Mr. MEANS. Not at all. We are limited to 40-acre tracts by the Land Office subdivision, but our tracts can be 40, 80, 120, or 160 acres. If it were possible for us to subdivide a 40-acre tract, I think there would be a large demand for small homesteaders for as low as 10 acres each. In some places you will find better conditions on 10 acres than on 160 acres.

Mr. VAN DUZER. Where does that condition obtain?

Mr. MEANS. In the Yakima Valley I know of farmers on such 10-acre tracts who are putting money in the bank every year, made from raising hops.

Mr. WILLIAMSON. Is not the average farm in Utah about 30 acres?

Mr. MEANS. Yes; about 30 acres.

Mr. REEDER. What is it in New Mexico?

Mr. MEANS. I think it is less than that—23 acres, I believe.

Mr. REEDER. I heard Governor Prince say some years ago that the average farm in New Mexico at that time was less than 10 acres. But I give that only from memory.

Mr. VAN DUZER. What crops do they raise in New Mexico that ill enable a farmer to get a maintenance on 10 acres for his amily?

Mr. MEANS. I think a great many Mexican farmers are easily satis-ed, and in some cases a family will live on 2 or 3 acres of lands—a ttle wheat, a little alfalfa, and so on.

Mr. C. J. BLANCHARD (statistician, Reclamation Service). Is not hat the average irrigated farm acreage in Utah—the area irrigated er farm in Utah?

Mr. MEANS. That is the average irrigated acreage. They may own nd outside. In Washington—the State of Washington—the aver-ge, I think, is about 35 or 40 acres. We are positively sure that in he two probably most progressive irrigated States, Washington and Oregon, the average is less than 40 acres. In such States as Wyo-ing, Montana, and Nevada, where cattle interests are predominant, he size of the irrigated farm is larger.

Mr. REEDER. This ruling that you can not get below 40 acres, is hat on account of the irrigation law of 1902?

Mr. MEANS. That is the reclamation law.

Mr. REEDER. That the unit of land can not be made less than 40 cres?

Mr. MEANS. It can not be less than 40, nor more than 160.

Mr. VAN DUZER. What is your opinion of the advisability of mending that eventually, so that they can get a 20-acre holding if hey wish?

Mr. MEANS. I think it would be very desirable if it were possible or us to subdivide a 40-acre tract into four 10-acre tracts.

Mr. WILLIAMSON. Why not remove any limitation, and base it upon he amount necessary to support a family?

Mr. BELL. You might fix the maximum.

Mr. MEANS. Yes; I think a maximum should be fixed.

Mr. WILLIAMSON. And let that obtain throughout our public lands, rrigated and otherwise, if it could be so arranged?

Mr. MEANS. The reclamation act provides that the size of the tract hall range from not less than 40 acres to not more than 160 acres.

The CHAIRMAN. The reason for that is that the public-land surveys lo not provide for a subdivision of the land for less than 40 acres. Some further provision would have to be made in regard to surveys f a lower limit is provided.

Mr. REEDER. It would not be necessary to change the general survey aws.

Mr. BELL. It might be surveyed under the Reclamation Service.

Mr. MEANS. This law, therefore, requires us to investigate the haracter of the land. It is our practice to investigate the districts vhere there is any question as to the value of the land, each individual 0-acre tract, to determine whether it is of any value at all, and vhether it would return to the owner sufficient funds to permit him o pay the cost of irrigation.

Mr. VAN DUZER. What is the size of farms in California?

Mr. MEANS. We have not taken up anything definitely in Califor-ia except the Yuma project, and there 40 acres will probably be the imit.

Mr. VAN DUZER. What is the prevailing farm unit in New Eng-and?

Mr. MEANS. I do not know just exactly what the size of farms is in New England.

Mr. VAN DUZER. Have you ever made any investigation comparing the farm unit in this country with European countries?

Mr. MEANS. Yes, in a general way. I may say that Egypt, probably the oldest irrigation country in the world, supported almost entirely by irrigation, has a population of about 12,000,000, and it has 6,000,000 acres of irrigable land under cultivation. We have tracts that compare with Egypt in the Yuma Valley, and it is possible they are capable of supporting or are actually supporting as much as Egypt will support.

Mr. VAN DUZER. That would make it a man to a half acre.

Mr. REEDER. Or person.

Mr. MEANS. Yes.

The CHAIRMAN. It would be difficult to bring the average American citizen down to the level of an Egyptian fellah?

Mr. MEANS. Yes; in southern California, as I remember it, the population is about one person to the acre of irrigated land.

The CHAIRMAN. Mr. Means, speaking of some southern Territories—Arizona, I think you said—would Arizona, under the conditions that exist there, support a family on 40 acres? You have made the farm unit there on the Salt River project 160 acres, or the largest unit allowable under the law.

Mr. MEANS. That is practically because there is no Government land under that project. In the irrigation of private lands it has been the rule to allow the owners to make their own limit.

The CHAIRMAN. I supposed it was pretty near necessary to do that in order to get the owners to agree to come under the provisions of the law. Is not that true?

Mr. MEANS. Yes, sir.

The CHAIRMAN. And your farm unit there is not what, in your judgment, might be the proper farm unit of the land that you control, but merely the best you could do under the circumstances?

Mr. MEANS. Yes; had we control of the Government lands for irrigation in that country I would be in favor of a very small farm unit.

Mr. REEDER. If a man obtains the water right under private ownership for 160 acres, must he use that right in order to retain it? Must there be constant use in order to retain the right?

Mr. MEANS. As I understand the law, it limits the right to beneficial use.

Mr. REEDER. I want to ask the chairman, because I know he is very well posted on these laws, if a man has the right to a certain amount of water, must he use that continually or lose the right?

The CHAIRMAN. Various State laws differ in that, as to what constitutes a nonuser.

Mr. BELL. In California it applies to a nonuser for five years.

The CHAIRMAN. In our State if a man does not apply the water to the soil for three years he loses his right.

Mr. REEDER. The man must use the water or they divide up the land themselves.

The CHAIRMAN. The supreme court of Nebraska, rather indirectly, I think—in an indirect way, as I understand—held that the water right could not be lost or forfeited in less than something like ten

s; not placing it, however, on the statute with regard to the use of water right, but in the common law affecting real estate titles in ral.

r. BELL. They probably had no statute on the subject in Nebraska.

r. NEWELL. I think that was a construction under the law of ıdonment.

r. MEANS. These people have to pay every year.

r. BELL. I think most of the States have laws fixing the pre- ɔtive time in which you can buy a water right and making it the ɜ in the case of abandonment.

r. REEDER. If they use the water profitably they have got to use

r. MEANS. There is one other thing. Whenever it is found neces- and advisable to make two sizes of farms in a district, as in the of the Truckee-Carson project, it should be arranged—the one ; for the support of crops for the mining camps, and possibly ıer valued crops can be grown upon that, on farms close to the ıs, and these will be smaller than the farm where a man raises ɛ. As a rule, there will be 40-acre tracts, or a man can take an 80- tract. It is probable that that same ruling will be applied to r irrigation projects.

r. VAN DUZER. What do you take into consideration in arriving at results—local consumption or local markets? In the case of Ne- ı, unless a railroad gives us a favorable rate we could not supply ırket 10 miles away from the farm so far as garden truck is con- ed. You speak of mining camps?

r. MEANS. Yes.

r. VAN DUZER. Except as to a few products the rates might be ıibitive. You might raise some things in some mining camps ıselves. In view of those farm units there, the value will depend ı the relief we are going to get through transportation facilities. could supply the world almost from Nevada if we had a way of ng our products to the market at a reasonable rate.

r. REEDER. I would like to say for the benefit of the gentleman ı Nevada that we have a Republican Administration, and that ıably rates will be ripe soon. [Laughter.]

r. VAN DUZER. I am with the Republican Administration on that ɔosition.

ıe CHAIRMAN. Allow me, Mr. Means, to interrupt you in order to Mr. Newell a question. I imagine, Mr. Newell, that very early in ɔrogress of your investigation, of your enterprise, you obtained a idea of what your farm unit is to be. Have you attempted to fy intending settlers, through the agency of the General Land ɛe or otherwise, as to what the probable farm unit would be, so homestead entries that are made may be made generally on the ; of that probable unit?

r. NEWELL. We attempt to notify the settlers, and the Depart- t says what the farm unit should be. But they held we could ıotify the settlers until the contract was let. So as a consequence Land Office has been allowing the settlers to take 160 acres, and the Land Office at a later date, when we come to make the con- t, would proceed to cut them down. Now the difficulty that has ɜn and the extreme competition that has resulted have finally, I k, led to a condition where the Office, although not reversing our

decision, is willing to let it be known what their intentions are; and their decisions have not been quite as drastic as before, and we are allowed also to withdraw on the first farm more liberally than before. We can thus protect our operations better and keep people away.

At first the Department was somewhat cautious about allowing us to withdraw that margin in the first farm, and preferred to leave it all open in 160-acre tracts. Since then they have been a little more liberal, and we can protect ourselves from encroachment better now, and arrange our soil banks when running near some man's claim for homestead. I think in the future we can announce in advance that these units will be only 40 or 80 acres; and while the Land Office will probably hold that they can not compel a man to take only 40 or 80 acres, yet he will see himself it is an advantage to make his filing at the beginning what it will ultimately be.

The CHAIRMAN. You will recall that I have had several talks with you about the farm units on the Shoshone project?

Mr. NEWELL. Yes.

The CHAIRMAN. And that it was your desire that that farm unit should not be above 80 acres?

Mr. NEWELL. Yes.

The CHAIRMAN. But for a time some entries were made for 160 acres?

Mr. NEWELL. Yes.

The CHAIRMAN. And I took the matter up in correspondence and in person with you, as you will recall, and with the Secretary also?

Mr. NEWELL. Yes.

The CHAIRMAN. At first they told us they could not do anything. They told us they could not permanently withdraw that 65,000 acres of Carey Act segregation. But finally more recently, either through your office or through the Department, a suggestion at least has gone out, so that I see that the land officials and the United States commissioners there now are calling attention to the fact that the farm unit will be 80 acres. So I judge from that that the Department, either directly or indirectly, or your office, has called attention to that matter quite recently. It is very wise, in my opinion, and very important that it should be done. Otherwise there would be a great deal of confusion when you come to cut down the unit from 160 acres to 80 acres.

Mr. NEWELL. Yes; the Land Office is becoming adjusted to it. They see that while a man can legally enforce his right to 160 acres, yet he may eventually have to relinquish some of it.

The CHAIRMAN. If they took 160 acres under those circumstances they might do it with the idea that they would get something in return for their relinquishment.

Mr. NEWELL. They would find it could not work, and——

Mr. BELL. It is a case of first come first served in respect to these lands that are to be irrigated?

Mr. NEWELL. Yes.

Mr. BELL. In some cases lands are withdrawn from entry. Does that cover homestead entries?

Mr. NEWELL. Yes; anyone can enter.

The CHAIRMAN. That provision of the law is necessarily restricted to comparatively limited areas of the country, and can not very well under the law include the general irrigated tracts.

Mr. NEWELL. The Department has been pretty liberal. We can not tell at first where we may want to put our construction camp, and unless a promise is made to withdraw we will be cramped in our work. That is our attitude toward the entry man. It is a great deal better to give us a liberal interpretation.

Mr. BELL. Aside from those withdrawals, that is simply a case of a man entering a homestead?

Mr. NEWELL. Yes; first come, first served.

Mr. TIRRELL. Where there is a lot of private ownership and public lands additional, do you withdraw the public lands?

Mr. NEWELL. We withdraw only lands that are not already taken up. We make a general blanket withdrawal of all the rights the Government has.

The CHAIRMAN. It is now 12 o'clock, gentlemen. Do you care to sit longer and hear Mr. Means further?

Mr. WILLIAMSON. I am very much interested in this soil matter.

The CHAIRMAN. We can come back later if we like. Shall we go on now or meet a little later in the afternoon?

Mr. REEDER. I suggest that we meet at half past 1.

Mr. BELL. I suggest that we go on for half an hour more and call it a day.

The CHAIRMAN. If there is no objection, we will go on for half an hour.

Mr. Newell, just for a moment. I intended to ask you a question while we were directly on a subject which we wandered away from. Speaking of the question of freight rates, you say in a majority of cases you have got what amounted to about 50 per cent of commercial rates. Does that include freight and passengers?

Mr. NEWELL. That includes 50 per cent of the freight rates; and then we have special concessions for bodies of laborers.

The CHAIRMAN. Since the passage of the Elkins bill, have the railroad people suggested to you that they are not authorized to cut rates and are subject to pains and penalties if they give you a rate below the published schedules?

Mr. NEWELL. I think the Government is allowed to get any rate it can. We can get it for nothing if we could.

Mr. VAN DUZER. You could not get it for nothing, could you?

Mr. NEWELL. In some places I think we can. I think there are some places where we can have absolutely free transportation, and I have lately considered the idea of getting the railroads to run us free, because it is to their advantage to get this work done.

Mr. BELL. It certainly is; and I think it is about time they began to subsidize somebody else a little bit, anyhow, after having enjoyed that privilege for a century.

Mr. NEWELL. The railroads will be the first beneficiaries of great construction works, and I believe they are beginning to meet that idea and to understand it.

The CHAIRMAN. Have you at any time made arrangements with the railroad companies on behalf of the contractors in the matter of transportation of laborers?

Mr. NEWELL. This agreement applies to contractors as well, and in letting contracts we state to the contractors that these rates can be had from the railroads, and they make their bids with that understanding of these rates; so that if we can get 50 per cent freight

rates into Cody the contractor bids with full knowledge that he those concessions.

Mr. MEANS. There is one other point I might mention in regar the classification of land, and that is that of the land that has b irrigated in certain portions of the West up to the present time calculations made by the Department of Agriculture show that land has been so ruined by alkali and seepage waters that it is unfit for production.

Mr. REEDER. Has that been caused by bringing the alkali to surface?

Mr. MEANS. In some cases it simply makes swamps of the land in other cases it brings the alkali to the surface. It comes from lack of drainage.

This point brings to our attention the fact that there has b something wrong in the methods employed in the past in the W Either they have irrigated worthless lands or else there is someth wrong with their irrigation system. We have considered that p and we hope to make safeguards in the future, so that no lands irrigated shall ever become worthless.

Mr. WILLIAMSON. I do not find that situation.

Mr. MEANS. In certain districts they have been almost free that trouble, but in other districts the damage has been very gr

Mr. WILLIAMSON. The damage is in the lower strata, or els on the surface, is it?

Mr. MEANS. In some places it is not visible, and the real agents in the West are pretty good at selling this land.

Mr. WILLIAMSON. How far down does that alkali rest?

Mr. MEANS. At Fresno, Cal., the alkali was originally at feet below the surface, and it has come up to the surface. Th no evidence whatever in that country of alkali at first, and her the ordinary surface examination of the soil would have reve knowledge of its existence; but the application of water has b it to the surface, in some cases extending sometimes over 30,00 The water has been raised to within 3 or 4 feet of the surface, that it keeps moist on the surface, and that has brought tha up. A very slight expense at the start would have prevented and at the present time it will cost those people from $10 to acre to reclaim that land.

Mr. REEDER. Is it possible to irrigate the land without b the water to the surface?

Mr. MEANS. Yes; that could be done by preparing the so orly.

Mr. REEDER. If the subsoil is right, so as to hold that water, irrigate without bringing the water to a higher level every ye

Mr. MEANS. Yes; I have examined such cases where we ha wet the ground down below 10 feet—only 6 or 8 feet—just t the roots grow, so that there has been practically no subd whatever.

The CHAIRMAN. In the majority of cases, or in a large nu cases, is it not true that the alkalizing of soils and the form swamps is caused by overirrigation, or the use of too much wa

Mr. MEANS. I may say in the majority of cases that is true due also to losses from canals.

'he CHAIRMAN. It is possible to conceive of conditions, Mr. Means, t exist which you could not foresee at the time you built an enter-se, where a sloping subsoil, catching seepage water from a large al, might gradually bring the alkali up to the surface at a point ie distance from the canal. Does not that sometimes occur?

Ir. MEANS. Yes; that sometimes occurs.

'he CHAIRMAN. Of course, that is impossible to foresee?

Ir. MEANS. Yes. We have certain districts along the North tte River and in Wyoming and in Nebraska and in the "Belle-rche region," as we call it, in South Dakota, where there is prob-r no alkali, but we can not predict what may happen in that coun-

But we know this, that there is never going to be a large amount lamage, although there are going to be limited areas that will irally become less valuable. The seepage water runs along layers mpervious material, coming out through the surface; and the enditure of a slight amount of money can be considered necessary, bably in the next ten years, to protect those lands. It will prob-r amount to a few cents per acre on the average.

might add that we have considered pretty carefully the results putting under irrigation in the West a large acreage of land. The jects at the present time include over a million acres, and it is sible that within the next ten years this million of acres will be ms. We have been considering the question of the kind of crops se farmers ought to grow and the best conditions for the growth those crops. These are things that are almost impossible to pre-t, but the Secretary of Agriculture has offered to help us in the iblishment of agricultural surveys where we have industries suit-e to the growth of the sugar beet. It is possible that Secretary lson will send his experts into the country to encourage their wth.

n the Klamath country and in southern California we have a cli-te that prohibits the growth of certain crops; and in those re-ns, of all the crops I know of, there is none so suitable as the ar beet. Near Klamath Falls they grow sugar beets, and I saw analysis of them which shows 21.7 per cent of sugar.

Ir. WILLIAMSON. How about alfalfa and hay?

Ir. MEANS. They are going to be the staple crops. The sugar-t land would be very valuable.

Ir. REEDER. They could not grow fruit out in that country?

Ir. MEANS. Yes; they could grow certain classes of fruit. I do believe there is any better country for apples than that. A very class of apples is grown there, or can be grown there. And y have there a very large acreage of peat soil, which is an ideal l for the production of celery, and the climate there is good for ery. And they have an ideal soil and climate for the production cranberries, which is a valuable product, and one which you can ord to ship. And this peat soil is ideally adapted to the growth asparagus, and you know that canned asparagus is used more l more throughout the country.

Ir. VAN DUZER. What do you mean by peat soil? Is it not a id of sod?

Ir. MEANS. It is a black soil, composed almost entirely of organic tter from the decay of swamp vegetation, where lakes have

gradually been filled up until the soil has been enriched with rank vegetation, which in turn has died and left a deep deposit. It is mixed with a certain amount of mineral matter.

Another thing we have in view is this: In the Yuma project Secretary Wilson, of the Agricultural Department, has been anxious to start the date palm—a crop which is not grown in this country, but which can be grown. We are importing anywhere from $1,000,000 to $2,000,000 worth of dates every year, and we could afford to grow those on our own land.

Mr. VAN DUZER. You say the Secretary of Agriculture is considering the possibilities of these various projects with a view to making experiments?

Mr. MEANS. Yes, sir. Secretary Wilson has promised us all the help he can give us. He has a large force of men for the introduction of new products and agricultural industries, and that work goes out simply as an encouragement to us without any cost to the Reclamation Service, and it will probably be extended to every project that we have anything to do with.

The CHAIRMAN. Is there anything further to be asked of Mr. Means? Does any member of the committee care to ask him any more questions? We have still fifteen minutes left.

Mr. Newell, if there is a man with a short story to tell, we should be glad to hear him.

Mr. NEWELL. I suggest that you should listen to Mr. Storrs, our electrical expert, who is in charge of the Missouri and North Dakota gravity supplies. If there is anything to be accomplished there it must be by mechanical devices.

Mr. VAN DUZER. Mr. Newell, does the reclamation investigation propose to take in artesian wells?

Mr. NEWELL. There is a collateral work carried on by the Geological Survey in the investigation of deep and artesian wells all through the West, and we have brought together and now have in the hands of the Public Printer for publication a map showing the depth of water over a great part of the central portion of our country. Now, the Secretary of the Interior has rendered a decision, which Mr. Reeder looked up yesterday, to the general effect that——

Mr. REEDER. I made up my mind yesterday that there were no artesian wells to be bored.

Mr. BELL. That is, under the present law?

Mr. REEDER. Yes; under the present law.

Mr. BELL. Then we can make an artesian-well law.

Mr. REEDER. The decision as to what this law says prohibits it. I got that from every officer who listened to me, clear up to the Attorney-General.

Mr. NEWELL. We can do it in any work where, according to the estimates of the engineer, the cost of that work will be refunded.

Mr. REEDER. But simply to make experiments—they have decided that they can not do that?

Mr. NEWELL. Yes. The reason for that decision is this: The moment the law was passed a large number of enthusiastic men, interested in getting water in any possible way, from the ocean or from the clouds—all ways that could be conceived of—came to the Department, and each one tried to show that his particular way was the

ɔer and the successful one; and the Secretary was finally com-
ɔd to say, in self-defense, that unless his advisers would say that
could get water, and it would be good water and in sufficient
ıtity to pay the cost, he would not authorize the expense.
ı the matter of artesian wells, the probabilities of getting a flow
pretty well established through certain parts of the country—
can say, nine chances out of ten, as to whether you can get water
e or not. If there is only one chance in a dozen the Secretary
probably say, "I am not justified in taking that chance." The
unt of water obtained from artesian wells for stock purposes and
municipal and farm supplies is wholly inadequate for any consid-
ɔle cultivation. It might cultivate an acre or two, but there is
lly one chance in a thousand for getting enough to pay for the

[r. COOPER. Is there any method, Mr. Newell, where, by testing,
can ascertain whether this alkali is underneath the surface, so
ɔ make it unprofitable to irrigate any certain tracts of land? Do
test for that?
[r. NEWELL. Mr. Means might have added that he is taking sam-
of the soil and preparing a map showing the amount of alkali in
ain areas, so that in the Carson sink country we have a few mil-
acres that is fairly good, and out of that we could take 200,000
300,000 acres of the best land, having reference to the amount of
ıli and sand dunes.
[r. COOPER. It seems to me it could be determined by drilling.
[r. NEWELL. Yes.
'he CHAIRMAN. It is true, is it not, Mr. Newell, that there is a great
l of land containing a considerable amount of alkali that, if care-
ly irrigated, would come to the surface at some time or other, but
he same time is not sufficiently charged with alkali to be unfit for
iculture under the most careful and intelligent irrigation?
[r. NEWELL. Yes; that condition is best illustrated in the Pima
ıtry, which we have recently visited. There the whole coun-
is underlain with alkali. Much of it not under cultivation is so
of alkali that it is valueless; but the cost of obviating that is
siderable, and there is the possibility that not much of that will be
ized beneficially. We assume that where people practice irriga-
ı intelligently and fairly.
'he CHAIRMAN. In an irrigated country we often see a field that
uined or absolutely worthless—black or white, as the case may be,
ending upon the character of the alkali—and right beside it a field
exactly the same soil and character practically producing wonder-
crops.
Ir. COOPER. That shows it is necessary to make scientific tests in
cases?
'he CHAIRMAN. No; the scientific test would have shown that the
d would sustain a considerable amount of alkali. Very few lands
he West are free from a considerable amount of alkali, and only
asionally do you find a tract that contains so much that it can not
ıtilized under proper conditions of irrigation; but still there is a
t area that could be easily ruined by overirrigation.
Ir. REEDER. I would like to ask this question: When this alkali is
eloped to such an extent that the land is worthless, you intimate

that it could be reclaimed with a certain expenditure per acre. How is that done?

Mr. MEANS. That work has been experimented upon by the Department of Agriculture, and it is simply a question of drainage and heavy irrigation.

Mr. REEDER. You mean wash it out?

Mr. MEANS. Yes; wash it out, practically.

Mr. BELL. The alkali is there because there has not been enough rainfall to create a subdrainage to take care of it and take it off?

Mr. MEANS. Yes.

Mr. BELL. The alkali will appear even in this eastern country, will it not?

Mr. MEANS. Yes; even in the District of Columbia here.

Mr. REEDER. Is that the process they are working at in the Salt Lake region?

Mr. MEANS. Yes, sir. The Department of Agriculture took up 40 acres of land two years and a half ago, and at a cost of about $16 per acre for drainage they have made land that was bare of vegetation now worth about $75 an acre, and as soon as there is a crop on it it will be worth $150 an acre.

Mr. VAN DUZER. Where is that?

Mr. MEANS. Near Salt Lake City. It was simply for a demonstration to the farmer that that work was carried on. Commercially in Egypt they have reclaimed probably over a million acres of land—the English engineers in that country have done that—at a cost there of about $30 an acre, and the land eventually was sold for $300 an acre in a great many cases.

Mr. REEDER. We can look for the remedy? That is possible?

Mr. MEANS. Yes; we have a remedy, and a remedy that is commercially possible all over the West. Some of the western farmers do not know what drainage means, and that is the work which the Department has been doing, putting out demonstrations.

The CHAIRMAN. It is now 25 minutes past 12 o'clock. Does the committee still desire to continue its session?

Mr. BELL. I think we had better hear Mr. Storrs.

The CHAIRMAN. Very well. Now, Mr. Storrs.

STATEMENT OF MR. H. A. STORRS, IN CHARGE OF THE GRAVITY SUPPLY INQUIRY.

Mr. STORRS. Two pumping projects have been tentatively authorized by the Secretary of the Interior in the last two or three weeks, one at Bismarck, N. Dak., and one at Buford-Trenton, close to the Montana line.

Those projects are somewhat involved in the reclamation work—that is, in connection with them there are a good many large gravity projects. There the feature of power development and pumping is considered as an adjunct to the main project. For instance, the one spoken of by Mr. Hill, in Arizona, where 50,000 acres may be reclaimed in addition to what may be reclaimed by gravity, and the Minidoka, Idaho, project, where the power will be developed at the diversion of the dam of the Snake River; and that power will permit pumping from the gravity supply to the canal and higher levels,

us reaching about 50,000 acres of land that would be too high to be ached by gravity.

The projects in North Dakota, however, involve no gravity fea- re worth mentioning. They are small projects compared with the hers. The one at Bismarck is limited to about 15,000 acres. The ıe at Buford-Trenton is limited to 18,000 acres. The field work as limited. The data on which we based the estimate was not quite ımplete, and it is quite possible that those areas may be somewhat :tended when the plants are finally built.

There are several conditions along the Missouri River which make is especially attractive as a field for pumping water. The supply practically unlimited. The benches along the banks were very vorably situated, many of them involving comparatively low fts—20 to 35 feet reaching the lower benches, and from that up to feet. And then the presence of an abundant supply of fuel is a ost important factor in the propaganda.

The lignite, while it has not been used commercially very much ıd is a fuel somewhat difficult to utilize economically, can, never- ıeless, be had at so low a price and so close to the pumping plant ıat it will supply fuel more cheaply than almost any other loca- on, I have no doubt. For instance, coal can be bought, delivered at ıe plant for $1.50 to $2 per ton, at the present market price; and if, is now contemplated, the coal is mined upon Government lands ljacent to the pumping plant, by the Government, it will be possible deliver the coal at perhaps half that price; and there is every pos- bility of locating a large electric generating plant at the site of the ıal supply and transmitting the power to the pumping plant. The ımping plants will be necessarily somewhat scattered, because the nd does not lie in large tracts, so that the electric power transmis- on and the electrically operated pumps would be the ideal arrange- ent there.

Mr. REEDER. What is the source of supply there—the Missouri iver?

Mr. STORRS. Yes; both of those projects are located on the Mis- ıuri River. I might say that there are three drainage areas in the tate there—the Red River, the Mouse River, and the Missouri River. ı the Red River basin they need drainage more than irrigation, and the Mouse River the low water supply is very limited, and the pos- bility of storage is much restricted because the water would be set ıck across the Canadian line if we endeavored to store water to any :tent in the natural stream. In the Missouri River basin practically l the streams go dry, or nearly so, in summer—the Little Missouri iver, the Knife, the Heart, and the Cannon Ball. Those go prac- :ally dry, and in the investigation of two or three seasons no favor- ›le sites have been found on these rivers for storing water, and so ıat has practically limited the work to the Missouri River itself, :awing directly from its natural flow. The possibility of damming ıe Missouri River and storing and diverting the water is a problem hich has not been seriously taken up as yet.

Mr. TIRRELL. What is the cost per acre for irrigation in that ›untry?

Mr. STORRS. The cost per acre during the first ten years, which will ıclude the cost of the work and the cost of operating the plant dur-

ing that time, on the basis of coal at $2 per ton, which is not very high, we think, would be in the vicinity of $3.50 per acre. That is on the basis of supplying 2 acre-feet per acre.

Mr. REEDER. Annually?

Mr. STORRS. Yes; that is the basis of our estimate at present. It is quite possible we may be able to cut that down in one or two ways.

Those projects are strictly pumping projects, but in connection with all of them are smaller streams that come in from the higher benches. Some of them have, in fact, nothing but spring floods. It is our idea, however, that we may be able to store spring floods in connection with these projects so that we can supply a considerable amount of the land at the higher level.

Mr. WILLIAMSON. Would not the cost depend to a great extent on the height or amount of lift?

Mr. STORRS. Yes. I spoke about these two projects particularly, which are quite the same. The average lift of these two projects is about 35 feet. Most of them are about 25 or 30 feet.

Mr. WILLIAMSON. And a lift of 35 feet, with coal at $2.50, would cost that?

Mr. STORRS. It would not exceed that. The question is raised whether it would not be desirable to have a fixed price, which could be paid for the maintenance of the plant, irrespective of the quantity of water pumped, and then have the water users pay an additional amount in proportion to the amount of water used. For instance, if they have a wet year—and they have been having several up there of late—it might easily occur that they would not need 2 acre-feet of water, and it would tend to economy in the use of water if the charge was made proportionate, to a certain extent, to the quantity of water used. But there would be the fixed charges covering maintenance and depreciation and care of the plant, which would have to be made whether they used water or not.

The CHAIRMAN. Those matters would all adjust themselves in the maintenance of any national project after the first cost had been paid and the ownership had been turned over to the settlers?

Mr. STORRS. Yes. I simply mentioned that feature as being somewhat different from what is the case in the gravity projects, where the first cost is so large with reference to the maintenance cost that it is difficult to consider it. Of course, in the pumping project the subsequent cost must be considered as of equal importance with the first cost.

The CHAIRMAN. What is your estimate of the cost of maintenance, excluding the initial first cost of installing the plant?

Mr. STORRS. The cost of the plant itself, the entire system—that is, the pumping plant and canal and so forth on these two projects—has been estimated at about $15 an acre. That means that $1.50 in the first ten years is paid to the first cost, and the balance, $1.50, or perhaps a little more, is to cover the maintenance and operating expenses.

The CHAIRMAN. What would be the cost of operating per annum, exclusive of the cost of the plant? What is your estimate of that? In other words, after the settlers had paid for the plant and it had passed under their control, what would it cost them per annum to maintain it?

Mr. STORRS. If they had to pay for coal at the rate we expect to, ıe rate would be $1.50 per year.

Mr. WILLIAMSON. Out in our country they are experimenting with ıese gasoline engines. What is your opinion about them? Do you ıink they are a success?

Mr. STORRS. I think for private purposes they are perhaps the best ıing in many cases that could be found.

Mr. WILLIAMSON. Do you care to say whether or not they are a ıccess, so far as demonstrated?

Mr. STORRS. Well, the comparative cost of pumping water through ırtain section of the country would indicate that in many locations ıe oil engine would be the best engine available.

Mr. WILLIAMSON. Do you think they are a success?

Mr. STORRS. Oh, yes; they will pump the water. It is simply a ıestion of how much you will have to pay for the gas engine. My ıcollection is at Phoenix they pay in the vicinity of 35 cents a ıllon for gasoline.

Mr. HILL. They pay 50 cents for coal oil, when they buy it.

Mr. STORRS. It depends, of course, on the cost of fuel.

The CHAIRMAN. Is there anything further, gentlemen? Does the ɔmmittee care to continue in session at this time? If not, when ill we hold our next meeting?

Mr. BELL. I suggest, Mr. Chairman—and I am as much to blame ; anyone for not being here promptly this morning—I suggest that ıe next meeting be held promptly at 10 o'clock, and then we can ɔnclude in two hours.

Mr. NEWELL. Most of our engineers are now going away, and I ıink we could very easily cover the remaining general topics in two ɔurs, or even less.

The CHAIRMAN. Whom have you here, Mr. Newell, who is familiar ith the Pathfinder project?

Mr. NEWELL. Mr. Field. Is he here?

Mr. STORRS. No; I think he has gone.

Mr. NEWELL. Mr. Savage is here, and Mr. Quinton is here. Mr. . P. Davis, the assistant chief engineer, can speak on all these ıatters from his standpoint of acting on the various boards. Mr. . H. Fitch, supervising engineer, is here, and he can speak parcularly on the Crow Indian Reservation and on the Wind River roject. Mr. George H. Hammond can speak of diamond well ɔring or drilling—that is the technical point of getting foundation. Ir. Lippincott, I think, you have heard on the Yuma project. Ir. E. A. Noble, the district engineer in charge of the State of Vashington, is present in the room now. He has charge of the ork in the State of Washington. Mr. H. T. Perkins, our transortation man, is in the city. Mr. Saunders and Mr. Quinton, conılting engineers, and Mr. H. M. Savage, supervising engineer, can ɔeak of the situation in Montana and Wyoming. I think that ıcludes all of them.

The CHAIRMAN. It would require a couple of more meetings to ɔver the territory well, would it not?

Mr. NEWELL. Yes; if you wish to hear from all of them. The ıbject is unlimited.

The CHAIRMAN. I think it would be well, now that the committee

has taken the matter up, to hear from the gentlemen in regard to each of the projects that has been undertaken, or at least carried to a point where you have begun construction. What would be the most convenient time for the next meeting?

Mr. BELL. Any day this week will suit me. Would Thursday be convenient? I would suggest that all of the committee get here promptly at 10 o'clock. I suppose Mr. Newell would like to have this hearing pushed as rapidly as possible?

Mr. NEWELL. Yes, sir.

Mr. BELL. I move we meet to-morrow, Wednesday, at 10 o'clock. Is that satisfactory, Mr. Chairman?

The CHAIRMAN. That is entirely satisfactory. I will not be able to be here myself, but I hope you will have a good attendance of the committee. Let it be understood, then, that we will meet at 10 o'clock to-morrow, and that the hearing will begin promptly at 10.

Thereupon, at 12.40 o'clock p. m., the committee adjourned until Wednesday morning, January 18, at 10 o'clock.

COMMITTEE ON IRRIGATION OF ARID LANDS,
HOUSE OF REPRESENTATIVES,
Wednesday, January 18, 1905.

The committee met at 10.30 o'clock a. m., Hon. C. Q. Tirrell in the chair.

The CHAIRMAN. Although a quorum is not present we will begin the hearings, as has been the custom; and Mr. Newell will please indicate whom he desires to call upon.

Mr. NEWELL. We have with us this morning gentlemen representing various projects which have not been discussed. Mr. Babb is prepared to talk on northern Montana; Mr. Fitch can talk on the Crow Indian Reservation in Wyoming and the Wind River Reservation in that State; Mr. Sanders is a consulting engineer and has to do with a good many projects, and he can speak of the Pecos River, in New Mexico.

Mr. Davis is the assistant chief engineer and is very familiar with all the conditions, but I thought he could speak to you of the Rio Grande. That is a very important international condition. Mr. Savage, one of our supervising engineers, has already spoken to you, but he can describe conditions in Utah and Washington, which I think are the only two States which remain to be spoken of.

The CHAIRMAN. Suppose you use your own discretion and call whichever gentleman you desire.

Mr. NEWELL. I suggest, then, that Mr. Babb speak of the northern Montana work.

STATEMENT OF MR. CYRUS C. BABB, DISTRICT ENGINEER FOR MONTANA.

Mr. BABB. Mr. Chairman and gentlemen, this represents a map of northern Montana from the Continental Divide down to the mouth of Milk River, where it empties into the Missouri River. The North Dakota line is about 100 miles to the eastward. The Milk River—

the drainage under special discussion—rises in the high plateau country adjacent to the Rocky Mountain Range. The North and South forks flow northeasterly into Canada, there uniting and continuing for something over 100 miles in Canada; then crossing the international line it reenters Montana and continues in a general easterly direction, coming into the Missouri River at this point. [Indicating on map.] St. Mary River drains the eastern slope of the Rocky Mountains. It continues northerly into Canada, empties into the Saskatchewan River, and is finally lost in Hudson Bay.

The valley of lower Milk River is especially adapted to irrigation. It is at an altitude of about 2,200 feet. The valley itself is 3 or 4 miles wide, and at the present time a considerable variety of the hardier crops are raised. The water supply of Milk River is deficient, however, and in certain years it can not be depended upon to furnish a sufficient amount, as it rises in the plateau region, being cut off from the mountain drainage by the St. Mary River. The problem in this case is to furnish a supplemental supply to Milk River. This can be done by storing the flood waters of St. Mary River in what are known as the St. Mary Lakes and saving the run-off from that basin, which, per square mile, is equal to the run-off of any of the river basins of the Eastern States. The snowfall is heavy. The run-off is supplied from some of the largest glaciers in the United States, outside of Alaska, including the Big Blackfoot Glacier and a number of others. A very steady supply is thus furnished in the summer time.

By the means of a canal 27 miles long we could carry the water from St. Mary River through the divide and turn it into the North Fork of Milk River. From there it could continue down through Canada into Montana and furnish a supply below for the agricultural lands.

The CHAIRMAN. What is the distance?

Mr. BABB. The distance is 27 miles, with no especially difficult engineering features. There is a very high ridge at this point [indicating on map] between the drainage of Milk River and St. Mary River, but a natural gap occurs in it, which seems to have been placed there for canal construction, as we go right through it on grade without excessive cut. With a 50-foot dam at the St. Mary Lakes we can store 250,000 acre-feet of water.

The first survey was taken up in 1900, and was carried eastward with the idea of continuing a long canal, keeping it in United States territory for the entire distance and carrying the water to the drainage of Milk River. This country [indicating on map] drains into the Marias River, which enters the Missouri, so that the first tributary of Milk River to be reached by the canal would be Sage Creek. That line was not deemed feasible, as it would be from 250 to 300 miles in length, and we had to abandon the plan.

Another proposition was to utilize the waters on the Blackfeet Indian Reservation and the lands adjacent to the eastward, but the rainfall there is considerable, varying from 17 to 18 inches and being at times 20 inches. The elevation is also higher than it is farther eastward, being in the vicinity of 4,000 or 4,500 feet, so that frosts occur throughout the year. Considering everything, it was not deemed as advisable or advantageous as irrigation in the lower Milk River Valley.

Then the idea was developed of carrying the St. Mary water across the north and south forks of Milk River, draining it into Cut Bank Creek, a tributary of Marias River, letting it down this river for 75 miles or so and then carry it in an artificial channel again to Big Sandy Creek, a tributary of Milk River. Milk River is in a deep coulee from the international line to Havre. The valley then broadens out immediately below into the agricultural lands.

Surveys were conducted for estimates of cost for a canal system for the lower Milk River Valley. A plan that was advocated a year or so ago was the diversion of Milk River near Dodson and the construction of a feed canal to what is known as Lake Bowdoin reservoir site. At present it is occupied by a small body of alkali water. By the construction of a number of embankments a fine reservoir could be formed.

There are a number of complications connected with this plan. For instance, the Great Northern Railroad passes through a portion of the lands that would be flooded. The present lake is now controlled by a cattle company. The Great Northern engineers made the survey this past summer for a change of track, and their estimates were presented to us last August. The estimated cost of that change and the modifications rendered necessary amounted to something like $400,000. The engineers, however, had not been authorized to make a statement in regard to the policy of the road dividing the expenses between the United States and themselves. That of course would have to be taken up with Mr. Hill direct, and then there were the other complications on rights of way. We dropped this plan, however, to a certain extent on account of the discovery of a reservoir on Milk River, known as the Chain Lake site, immediately south of the boundary line. This plan necessitates the construction of an earth dam about 100 feet high. The reservoir thus formed will store the flood waters of Milk River and will also store the waters of St. Mary River if these latter are brought down through Canada.

If the Marias scheme is developed, this water can be brought right around and turned into the Chain Lake Reservoir. This reservoir is above all the agricultural lands of the Milk River Valley, and has a capacity sufficient for their entire needs. I spoke a few moments ago of the valley widening out just below Havre. Two diversion systems are planned for the valley, one near Chinook and the other below, near Dodson.

For the Chinook system [indicating on map] we have had surveys made for canals both on the north side, as represented by this line [indicating on map], and also on the south side, not here shown, as we have only completed the survey this past season. This north canal will be about 50 miles long and the south canal about the same length. They will cover about 110,000 acres of land. The Dodson canal system below here [indicating on map] would cover 140,000 acres of land, so that the total irrigable area in the Milk River Valley from the diversion at those two points is 250,000 acres.

Mr. WILLIAMSON. How much of that land is owned by individuals?

Mr. BABB. About 48 or 50 per cent is Government land and the rest is private land.

The CHAIRMAN (Mr. MONDELL). Is any of it railroad land?

Mr. BABB. No, sir; this is the Great Northern Railway. They have no railroad grants.

Mr. BELL. Do you anticipate any trouble from Canada? I see that has been spoken of in the newspapers.

Mr. BABB. Yes, sir; we are having difficulty in regard to the settlement in a way. The Canadian route is the most feasible. The project should be developed along the best physical lines. The route is of considerable length, but the natural supply of Milk River will offset all seepage losses.

Mr. BELL. Are there agricultural lands upon the river that could use that water in Canada?

Mr. BABB. Yes, sir. The St. Mary River flows north into Hudson Bay. There is a large irrigation company that has the sanction of the Canadian government. It is called the "Canadian Northwest Irrigation Company." They divert the water from St. Mary River about 7 miles north of the line. The canal lateral systems are about 200 miles long, about 30,000 acres being irrigated. The canal was finished in 1902. They have also recently started the construction of a canal from the north fork of Milk River at about this point [indicating on map]. It passes through the divide traversed by the Alberta Railroad. That is the only possible point where they could construct a canal to cover any considerable country. The topography is rather peculiar there. This canal could come in and the waters of St. Mary and Milk rivers could be brought together to irrigate lands to the north.

Mr. BELL. Have they served any formal notice, either this company or the Canadian government, upon our people?

Mr. BABB. Yes, sir; we have had quite a good deal of correspondence through the British ambassador, and we have also taken up negotiations with the Canadian people, unofficially, regarding the division of those waters. The matter is now in the hands of the State Department.

Mr. BELL. Are there any precedents that your legal department has been able to find governing an international question of that kind, where a different nation has any servitude or easement at all, especially where the watershed is entirely upon our own territory?

Mr. NEWELL. In the Rio Grande, and I think on the Colorado River, the Attorney-General has rendered an opinion that those servitudes lie in the waters running within the United States and that legally we might hold and utilize all the water which falls upon the United States and utilize it in New Mexico or California before it passes over the Mexican border. On the Canadian side, the Canadians have by their action intimated that they could store all the water which flows from Canada into Montana.

The St. Mary water which we propose to store and divert is the flood flow. In answer to their protest we have stated that we do not propose to interfere with the low-water flow, but that the flood water, which is destructive to them, washing out their head gates, etc., we propose to hold on our own soil and utilize on United States territory as far as possible in an economical way. It will be better for them if they will permit us to run that water down the Milk River and will agree that they will take only a certain portion of it at their canal diversion. Their present diversion from Milk River and carrying it

northward will not be, in our opinion, a financial success unless they can reenforce that canal with a certain steady flow, because Milk River is very low at times. We will consider permitting them to have some of our stored water for that canal if they will agree with us that they will limit themselves to a certain amount, permitting the remainder to pass through Canadian territory for this great valley below in Montana. As Mr. Babb has said, if this project was all in the United States or all in any one State that would be the most economical and effective way of handling the conditions. There are alternatives, but they are more expensive, and until we learn absolutely from the Canadians, yes or no, whether they will permit us to run the water through Canada, deducting a reasonable amount for toll, it is not good business enterprise to take the alternatives which are more expensive.

Mr. BELL. Has the State Department suggested negotiations to the Canadian department?

Mr. NEWELL. The State Department has asked the British embassy to bring the matter before the Canadian people and asked them to designate a commission or to take the matter up in some form so that we may reach a decision. The matter is rendered extremely pressing from the fact that there already exists in the Milk River Valley a number of small irrigation ditches and property of great value, aggregating hundreds of thousands of dollars, and the people in this valley are in danger of very great loss of property and suffering unless some step is taken by our Government to prevent the Canadians taking Milk River waters which have been appropriated and put to use in past time in this country, and we have asked them to apply the same principles which we offer to them, viz, to recognize the priority of appropriation and of use.

Mr. BELL. Then, those negotiations stand in the way of carrying out the project unless you should adopt the alternative of carrying the water through American territory?

Mr. NEWELL. Mr. Babb is to close up his work to a certain point pending the completion of those negotiations.

Mr. VAN DUZER. What river is that?

Mr. NEWELL. That is the Milk River, flowing through here [indicating on map].

Mr. BELL. I presume if Canada should refuse to recognize American rights here on the Milk River on the same ground that you would recognize their rights of appropriation on their territory, and if you did use this water entirely upon American territory, you would not feel bound in any way to observe their right to any water in the St. Mary River?

Mr. NEWELL. That is the point.

Mr. BELL. You would take all of it, flood and regular flow?

Mr. NEWELL. If they establish the fact that they will not recognize our right, whether the water comes from the United States or not, then we would be in a position to say, "We will take the entire flow of St. Mary River and use it ourselves, but if you wish to deal fairly with us, we will recognize your equities if you recognize ours." It would be a great deal cheaper for us to puruse this course.

The CHAIRMAN. I was not present when the hearing commenced. Do I understand that you are proposing a project now on the Milk River that will involve international questions?

Mr. NEWELL. Our proposition is to settle the international question f we can, as that will afford the cheapest method. If, however, the Canadians will not enter into an agreement with us then we will at once adopt the more expensive and difficult method of taking the entire flow of St. Mary River across the ridges of the forks of Milk River and keep it in the United States.

The CHAIRMAN. Do I understand that you do not propose to do anything at all on Milk River until you have settled those questions?

Mr. NEWELL. We are at a point where we have handed the matter o the State Department, and we can not do anything further until it s decided one way or the other.

The CHAIRMAN. I was under the impression that you had a later proposition to use some of the water of Milk River, and that there was a certain amount of water in that stream that could be utilized without raising that question.

Mr. NEWELL. The recent construction of the Canadian canal from Milk River brings the whole matter into a situation where the international feature has to be decided.

The CHAIRMAN. Is there any considerable amount of irrigation on he Milk River in the United States now?

Mr. BABB. Quite a large area, probably 80,000 acres under ditch, 30,000 of which is irrigated.

The CHAIRMAN. Where is that?

Mr. BABB. There are about 30,000 acres irrigated from Chinook down to Harlem.

The CHAIRMAN. That is liable to be affected by the proposed Canadian diversion?

Mr. BABB. Yes, sir. We were flooded with petitions last winter from settlers and others when that canal was first started. The valley is very fertile. Under one little ditch about 20 miles long crops were raised in 1904 to the value of half a million dollars. One man with 900 or 1,000 acres made in the vicinity of $30,000, $25,000 on hay and about $5,000 on potatoes.

Mr. TIRRELL. Are there many farms there now?

Mr. BABB. There are about 30,000 acres that were irrigated during the past season. There would be from 300 to 400 families. Havre s quite a town of about 1,200 inhabitants. Then there are smaller towns of 200, 600, and 800 inhabitants.

The CHAIRMAN. The diversion of St. Mary River which you propose would practically destroy the Canadian irrigation system—that is, you could so divert St. Mary River?

Mr. NEWELL. No, sir; our proposition is to utilize only the flood flow of St. Mary River, which now passes down the river and is lost.

The CHAIRMAN. I am speaking of our position from a diplomatic standpoint.

Mr. NEWELL. If we are forced to we can take away practically the entire flow of St. Mary River.

The CHAIRMAN. In other words, if they insist on taking all of Milk River and refuse to recognize prior rights in the United States, we could retaliate by taking all of St. Mary River, practically confiscating that whole irrigation system?

Mr. NEWELL. Yes, sir.

Mr. TIRRELL. How much would it cut down the flow of Milk River f you took away the water from St. Mary River?

Mr. NEWELL. We could take nearly the entire flow, although there is some water that comes in below our diversion point that we could not divert.

The CHAIRMAN. You say they are irrigating about 200,000 acres from St. Mary Canal now?

Mr. BABB. Only about 25,000 acres.

Mr. BELL. But the canal is 200 miles long?

Mr. BABB. The entire system with laterals is 200 miles long. The main canal is about 60 miles long.

The CHAIRMAN. That canal does not take all the waters of St. Mary River?

Mr. BABB. No, sir; they only take the low-water flow. They have no storage on the St. Mary. We will recognize their prior rights in our negotiations.

The CHAIRMAN. Is that the limit of the low-water flow of St. Mary, about 25,000 acre-feet?

Mr. BABB. Pretty nearly; yes, sir. By storing we can supply any deficiency during the low-water season, and also by storing the floods we can protect their head gates and the upper reaches of their canal. Nearly every year there is a destructive flood in St. Mary River.

Mr. NEWELL. I would like to add that our proposition is of the greatest value to them because they now have to depend on the low-water flow. They have laid out a very large skeleton system embracing an enormous territory, which they can not supply without storage. We have the storage and can supply them through this canal with water which will insure the success of their great system there without depriving us of anything we really need. So the two projects are really close together, and warfare between them means that they will be the larger sufferer.

Mr. TIRRELL. Are there public lands on the Milk River in Canada?

Mr. NEWELL. They are all under grant to this company. They have absolute control of that land under a grant of the Dominion authorities.

Mr. WILLIAMSON. After allowing them the toll how much would be left?

Mr. BABB. We would have sufficient for 200,000 acres of land. We are simply acting according to the irrigation laws of our country and their country, but the matter being between two countries it is only possible to come to an agreement very slowly.

Mr. WILLIAMSON. You would be allowing them some 40,000 or 50,000 acre-feet?

Mr. BABB. Somewhere in that vicinity. The minimum run-off of St. Mary River is 600,000 acre-feet of water, and some years it exceeds a million acre-feet. So there is a very large supply of water in St. Mary River.

Mr. BELL. I thought a while ago you spoke of storing 250,000 acre-feet?

Mr. BABB. That is the storage capacity of the reservoir, but by running the canal at the same time the reservoir is filling, simply using that as a regulator, we can control 600,000 acre-feet of water. The canal is carrying about 84,000 acre-feet of water a month.

Mr. WILLIAMSON. You would give the Canadians more water than they now have, besides reserving 200,000 acre-feet for yourselves?

r. BABB. Yes, sir. They are favorable to the proposition. Mr. , president of the company, and Mr. Newell and myself have informal conferences and they seem anxious to settle the matter. now a question of the machinery, getting it through our Depart- ts and the British embassy.

r. WILLIAMSON. You say they are favorable?

r. BABB. Yes, sir. Mr. Galt is an influential man. He is a ctor in railroads, in the Galt coal mine, has close relations with Canadian government, and the Canadian minister of the interior, they all seem to be favorable to it. It is simply a matter now of artmental machinery.

r. WILLIAMSON. Are there any difficult engineering features to come after you get down in this valley?

r. BABB. No, sir; none but what can be overcome. It simply ns diversions near Chinook and Dodson, and the construction of Chain Lakes dam at this point [indicating on map], about 100 high. It is difficult, but not unprecedented in any way.

r. WILLIAMSON. Then, if these terms can be made with the Cana- n people, you regard it as a feasible proposition?

r. BABB. We can take all the St. Mary water away if they do not e to terms.

r. WILLIAMSON. If you can make the terms, you regard the whole position as feasible?

r. BABB. Yes, sir; in my estimation.

r. TIRRELL. How many acres of land can be irrigated under your posed project?

r. BABB. Two hundred thousand acres under the Milk River position, and then there is another area in here [indicating on] if we develop from the Marias afterwards.

r. TIRRELL. How large is that?

r. BABB. That is just about the same—225,000 acres.

r. BELL. You could reach that by turning all the water through erican territory, practically bringing 425,000 acres under that ject?

r. BABB. The Marias River itself has a good water supply; the n under it is a fine body of compact and level land. The greater portion of it—175,000 acres—could be served directly from the ias line, making that an independent project. We plan ulti- ely to develop this area. The Marias project has difficult engi- ing features.

r. BELL. You have another project farther south?

r. BABB. Yes, sir; the Sun and Teton project. That is a project has been investigated by Mr. Robbins especially.

r. BELL. How many acres do those two projects comprise?

r. BABB. The Sun River project comprises somewhere in the vi- ty of 175,000 acres; the Teton project has not yet been developed.

r. BELL. You have great opportunities for irrigation in Montana?

r. BABB. Yes, sir; I think the water supply of Montana is one of finest in the United States; so that the possibilities there are very d.

r. NEWELL. I might add that this is a small part of Montana. could in that State utilize the entire reclamation funds with good jects now well in hand and still not by any means exhaust the

opportunities, and that is one of the unfortunate conditions of our work, that the opportunities are so very great that in one State alone we could put all our men and forces and still not by any means exhaust the great opportunities for development.

Mr. TIRRELL. Did you select this project as the most feasible to develop the most land?

Mr. NEWELL. Milk River was one of the first projects selected, because at that time it appeared to be one of the best; the subsequent difficulties to the development which we have learned render it now, from our standpoint, not as desirable as some others, but we have put so much time and energy in it that we are exceedingly anxious to have the question settled definitely. From our personal knowledge I do not think that it is as good a project as the Sun River, or has developed to be as good from an engineering standpoint.

I suggest that Mr. Fitch speak next about the adjacent country south of here [indicating on map], in southern Montana and Wyoming, the Crow Indian Reservation, of Montana, and the Wind River Reservation south of that.

Mr. VAN DUZER. Have you arrived at any general figures of what it would cost to develop the State of Montana alone, with a view to perfecting the system in that State—that is, all the reasonably feasible projects?

Mr. NEWELL. As a rough guess, I should say $50,000,000.

Mr. BELL. And about 2,000,000 acres of land.

Mr. NEWELL. It is the largest State in the Union, next to Texas, and its water supply is very great, coming from the high Rocky Mountain system and flowing in both directions.

Mr. VAN DUZER. How many years would it take to complete that State? Ten years?

Mr. NEWELL. Yes, sir; and probably twenty years. It could be done in ten years if we had all the men immediately available, but it takes a certain amount of time to develop men and methods, and to do it economically it would require pretty nearly a generation.

STATEMENT OF MR. C. H. FITCH, SUPERVISING ENGINEER, RECLAMATION SERVICE.

Mr. FITCH. Mr. Chairman and gentlemen of the committee, the northern portion of the Crow Indian Reservation, which is this portion in here [indicating on map], was ceded to the United States under certain conditions, one of which was the payment of $1,150,000 for the benefit of the Indians and the surveying of the lands. After the completion of the allotments on the ceded strip the Indians are to take the allotments on the ceded strip or move to the diminished portion, and the land was to be disposed of at a cost of $4 an acre, under the homestead laws, in addition to the cost of the reclamation, which is provided for in the act of Congress which turned it over to the reclamation service.

The irrigable lands lie in the Yellowstone Valley, on the south side of the Yellowstone and the west side of the Big Horn River. This is the Big Horn in here [indicating on map]. This is the Yellowstone [indicating on map], flowing on the north side of the ceded portion.

During the season of 1904 preliminary surveys were made to outline a comprehensive system of irrigation to cover the lands men-

tioned. These surveys will enable detailed estimates of cost and plans for construction to be made, as well as furnishing data for the segregation of the land. The work done has shown that the principal bodies of land can be covered by four canal systems and one ditch, as follows:

In Yellowstone Valley the most important body of land lies between Huntley and Bull Mountain station, on the Northern Pacific Railway, and comprises about 30,000 acres. There [indicating on map] is Huntley, and it takes in the land between the Northern Pacific Railway and the river. The Huntley Canal line as surveyed is about 40 miles long and can be cheaply constructed after the first 2 miles or so, which lie along the Huntley Bluffs. The difficult part of the line has been covered by plane-table sheets on a scale of 100 feet to the inch, and the remainder, being in smooth country, has been staked out and traversed and the slopes taken by stadia readings.

A few miles below the end of the Huntley Canal line the diversion point of the Custer ditch was selected. The Huntley Canal could not be continued on account of the Bull Mountain Bluffs. The Custer ditch is about 19 miles long and will not require any difficult construction work; it will cover about 5,000 acres of very good land. The land lies in a narrow strip between the river and the bluffs, the widest portion being opposite Custer station.

Below the mouth of the Big Horn there is a fine body of land extending from Meyers station, on the Northern Pacific Railway, to about 6 miles of Forsyth. The largest part of this land lies in the neighborhood of Sanders station and is known as the Sanders Flat. A canal line was surveyed to cover Sanders Flat and the adjoining lands along the Yellowstone; this line covers about 20,000 acres, of which about 6,000 acres are off the reservation.

This [indicating on map] is in the lower portion. This [indicating on map] is Sanders Flat. Here [indicating on map] is Forsyth, and this [indicating on map] is the Custer Canal.

In order to cover so much ground water must be diverted from Big Horn River about 4 miles above its junction with the Yellowstone, or from the Yellowstone itself about 3 miles above the junction. A line at this elevation covers the land, but entails about 7 miles of difficult construction where the bluffs approach the river, the railroad having already taken the best place for its right of way.

The difficult portion of this line along the bluffs has been covered by plane-table topography, from which it is expected to work out the best location and estimate the cost. The choice of the diversion site will depend somewhat on relative cost, but mainly on the water supply.

All of the lands in Yellowstone Valley are traversed by the Northern Pacific Railway. The upper end of the Huntley Flats are also crossed by the Burlington and Missouri Railway. These facts are material in considering the value of the lands and the cost of construction work.

The surveys show that the lands along the west side of Big Horn River may be watered by means of two canal systems. The Fort Custer Canal is surveyed to take water from the Big Horn near the mouth of Two Leggin Creek. This point is about 10 miles above the Burlington and Missouri Railway crossing at Old Fort Custer and is at the upper end of the long strip of flat valley land extending nearly

to the junction. By means of drops in the line at suitable intervals the Fort Custer Canal line is kept close to the edge of the hills without climbing into them, as this would increase the cost far beyond any benefit to be derived. There are probably 30,000 acres to be irrigated by this canal. The line as surveyed would be approximately 45 miles long.

This [indicating on map] is the lower canal line—the Fort Custer Canal along the west side of the Big Horn River. Next [indicating on map] we have the high line, diverted from the Big Horn at the mouth of the canyon.

The Big Horn high line has been planned to cover the high bench land extending from near the mouth of Big Horn Canyon to Two Leggin Creek and beyond, but from Two Leggin Creek the bench lies back from the river, leaving the flat valley land, which is to be covered by the Fort Custer line. The Big Horn high line, as surveyed, gradually mounts the divide until in the vicinity of Toluca, where the Cody branch leaves the Burlington and Missouri Railway, it is possible to cut through and deliver water to lands along Fly Creek, on the Yellowstone slope. By continuing the line on past Peritsa station the bench lands above the Fort Custer line are covered. Under the Big Horn high line and its branches there are possibly 65,000 to 75,000 acres of irrigable lands.

Within the Fort Custer Military Reservation there are about 10,000 acres which would be added to the low line of the Fort Custer Canal. At the upper diversion there would necessarily be a high-line canal in order to divert that water and reach the lands on the bench by means of a dam about 100 feet high. There is a very good dam site at the mouth of the canyon, and the dam would not be very long.

On the Huntley, Sanders, and Fort Custer canal lines are drops of from 12 to 50 feet, some of which at least could be utilized for the development of power. If the Big Horn high line is built it will involve the construction of a dam at the mouth of the Big Horn Canyon which would probably reach to 100 or 120 feet above high watermark. The amount of water passing this dam must always be sufficient to supply the Big Horn Indian ditch and the Fort Custer Canal, each of which covers about 30,000 acres. Surveys have been made which show that all the power developed can be used to pump water onto lands above the canals, but the details have not been worked out.

Mr. BELL. Originally this was all an Indian reservation, excepting this military reservation?

Mr. FITCH. Yes, sir.

Mr. BELL. Do I understand that the Indians have ceded a large portion of this reservation? And of course there is a portion remaining to the Indians?

Mr. FITCH. Yes, sir; there are 1,100,000 acres shown by this shaded line [indicating on map]; that is the ceded portion. This [indicating on map] is the unceded portion or the diminished reserve.

Mr. BELL. The Indians were given the right to lands in either the ceded or the diminished portion?

Mr. FITCH. Some of the Indians are already living in the ceded portion, and the endeavor is to get the Indians together on the diminished portion.

Mr. BELL. What is the total acreage under the Indian ownership?

Mr. FITCH. I have not the figures on that. The ceded portion is about 1,100,000 acres.

Mr. BELL. That is pretty nearly all land that can be cultivated?

Mr. FITCH. It can not all be cultivated.

Mr. BELL. Can a large portion be cultivated?

Mr. FITCH. About 200,000 acres would probably be classed as irrigable.

Mr. BELL. What do you figure as the total acreage on the Yellowstone?

Mr. FITCH. Two hundred thousand acres would be the amount that would come under the various ditches I have mentioned.

Mr. BELL. And this military reservation consists of 10,000 acres?

Mr. FITCH. It is more than double that, but there are 10,000 acres on the west side of the river which may be irrigated.

Mr. BELL. By law that can be thrown open and offered for sale, or. by special act of Congress, could be opened for homesteads. If it is abandoned as a military reservation what becomes of it?

Mr. FITCH. It reverts back to the Indians. It belongs to the Indians now. It is in the diminished portion.

Mr. BELL. It has been abandoned as a military reservation?

Mr. FITCH. It has gone back to the reservation of which it was once a part.

The CHAIRMAN. Is this [indicating on map] the line of the Big Horn Canal?

Mr. FITCH. That is the high line. There is a lower line next to Fort Custer.

The CHAIRMAN. Where is that?

Mr. FITCH. At the mouth of the canyon.

The CHAIRMAN. Is this Toluca [indicating on map]?

Mr. FITCH. Yes, sir.

The CHAIRMAN. You run above Toluca?

Mr. FITCH. Yes, sir; to the west of it.

The CHAIRMAN. You keep above the line of the Burlington all the way through?

Mr. FITCH. Yes, sir; one runs down on this side [indicating on map] and one on the west side.

The CHAIRMAN. How much of this territory in here [indicating on map] is irrigable?

Mr. FITCH. That is a very rough country and not irrigable.

The CHAIRMAN. What irrigable land can you get under this canal; is it mostly in through here [indicating on map]?

Mr. FITCH. No. The high-line canal will be between that and the river all the way down, but this [indicating on map] is in the diminished reserve.

The CHAIRMAN. I understand.

Mr. FITCH. All of this land in here [indicating on map], between that and the river down to the Fort Custer line, would go above Fort Custer and irrigate an additional area.

The CHAIRMAN. You could irrigate nothing above this line [indicating on map]?

Mr. FITCH. That is all rough land. This [indicating on map] is along Fly Creek and covers quite a large area.

The CHAIRMAN. Where do you propose to tap the Yellowstone?

Mr. FITCH. About 2½ miles above Huntley.

The CHAIRMAN. How much have you estimated under the Big Horn Ditch?

Mr. FITCH. Under the high line alone?

The CHAIRMAN. Yes, sir.

Mr. FITCH. Approximately 70,000 acres.

The CHAIRMAN. And under the low line?

Mr. FITCH. About 30,000 acres under this [indicating on map] on the Big Horn.

The CHAIRMAN. You propose to irrigate about 1,100,000 acres from the Big Horn River?

Mr. FITCH. No, sir; 1,100,000 is the area of the ceded portion.

The CHAIRMAN. How far along have you gotten with your surveys on those projects?

Mr. FITCH. This lower survey has been completed so that this winter estimates are being prepared for presentation for approval. This high-line canal will take further investigation before that can be finally completed.

The CHAIRMAN. What do you figure it will probably cost?

Mr. FITCH. That has not been figured out yet.

The CHAIRMAN. That runs through a country well provided with transportation facilities?

Mr. FITCH. Yes, sir; excellent.

The CHAIRMAN. And a very good water supply?

Mr. FITCH. Yes; a very good water supply.

WIND RIVER RESERVATION, WYOMING.

If you are through with the Crow Reservation, I will speak of the Wind River project. This [indicating on map] is the Wind River Reservation, in Wyoming. This portion of it, north of the Wind River, is proposed to be ceded to the United States. Reconnoissance was made there during the past season, but no completed survey, by Mr. Drummond, with one man who acted as cook, teamster, and rodman, and he went over the entire area of the ceded portion, as well as a large portion of the Indian reservation as it will be when diminished, for the purpose of getting a thorough knowledge of the water supply.

The proposed ceded strip of the Wind River Reservation comprises an area of approximately 2,283 square miles, extending eastward from the north fork of Wind River on the west to Big Horn River on the east, and northward from Big Wind River to Owl Creek. Owl Creek is up in here [indicating on map].

The irrigable area embraced within these borders is approximately 230,000 acres, lying east of Crow Creek, between Big Wind River and Owl Creek Mountains. Crow Creek comes in here [indicating on map]. A line was surveyed out about 47 miles to that line [indicating on map] and, as may be seen, it will cover land beyond that to Muddy Creek.

The greater portion of this land is rolling, but can be easily watered. The soil is a sandy loam, warm and fertile, covered with sagebrush. Wheat, oats, rye, barley, alfalfa, potatoes, and garden vegetables are grown very successfully on portions of this strip, and

there is no doubt as to the fertility of the soil when properly irrigated. As the land is rolling and has a good drainage, very little of it will be injured by seepage water. Within the area are a number of sand-rock buttes, ranging in size from one-half acre to 160 acres and extending over the entire strip between Big Wind River and Muddy Creek.

With the exception of that portion lying within the Big Bend of Big Wind River, comprising 20,000 acres, these buttes make it difficult to determine with any degree of accuracy the amount of irrigable land, and until a topographic map has been made only an approximation is possible. It is believed that the estimate of 230,000 acres, however, is conservative.

In Big Bend of Big Wind River, extending north and west, are about 20,000 acres of fine bottom sagebrush land, sloping toward the north and east. North of Muddy Creek, a small stream flowing east through the irrigable land for a distance of 20 miles and then south through Owl Creek Mountains, are some 40,000 acres of fine sagebrush land, with a slope to the east and south. Between the Big Wind River and Muddy Creek is the largest body of land, approximately 190,000 acres. South and east of Popo Agie River are about 10,000 acres of rolling land, sloping to the north and east, which it is believed will be difficult to water.

That is in this portion [indicating on map], on the south side of the river.

The source of water supply is in Big Wind River and its tributaries, which have an approximate drainage area of 2,000 square miles. A measurement was made of this stream on October 19, 1904, at which time the headwaters had begun to freeze and its flow was retarded. The discharge was 406.3 second-feet. This measurement was made at a point about 2 miles above the mouth of Bull Lake Creek and about 7 miles below the point of diversion of the proposed canal. This measurement could not be made before because it could not be measured from a bridge, there being none, and it was not fordable, and there was no means of making any measurement without wading.

Mr. BELL. What was the discharge there?

Mr. FITCH. 406.3 second-feet.

In the event that the water supply should prove insufficient to irrigate the land without storage reservoirs, there are three reservoir sites above the head of the upper canal, with a combined capacity of 121,000 acre-feet. These are in three lakes, viz, Brooks Lake, 25,000 acre-feet; Troy Lake, 26,000 acre-feet, and Dinwoody Lake, 70,000 acre-feet. The last-mentioned lake is in the diminished strip of the Shoshone Indian Reservation, but can not be used for storing water for Indian lands, nor will its use in any way be of damage to the Indians if utilized for storing water for the proposed ceded strip. If water is stored in it it will not flood any grazing land, as the surface area will be increased but little. Dinwoody Creek flows from this lake, and measurements taken on August 29, 1904, show that it had a discharge of 425.6 second-feet.

At Bull Lake, which is also on the diminished strip, a dam 50 feet high could be constructed at little cost which will store 120,000 acre-feet. Bull Lake Creek was measured on August 22, 1904, when it had a discharge of 498.9 second-feet. Bull Lake Creek is a small

creek which flows into the Wind River. At that time it was larger than the Wind River was in October, because at that time the freezing had commenced in the high mountains and the flow was retarded.

That portion of the land lying south and east of Popo Agie River will probably have to be irrigated from stored water, and there are numerous lakes on this stream in the mountains which may be utilized for this purpose. It would not be necessary to store water except that the Indian Department is now contemplating to use this water for the Indians.

Shoshone Lake, on south fork of north fork of Popo Agie River, will have a capacity of 10,000 acre-feet, with a 40-foot dam across its outlet, and the volume of water would be ample to fill it, as the headwaters of this stream are in a region which has heavy snowfall. Big Popo Agie River, below its junction with Little Wind River, on August 17, 1904, had a discharge of 592.3 second-feet. North Fork of Popo Agie River, on August 31 had a discharge of 118.8 second-feet.

A survey was made during the fore part of July, 1904, of a high-line canal. Its head is just above the mouth of Crow Creek, which is here [indicating map].

The canal line is located on comparatively level ground and extends about 72 miles to reach 40,000 acres of land north of Muddy Creek. Laterals can be constructed from the canal to cover all the land, but it is believed that other canal lines can be taken out at a less cost than the laterals, and owing to the fact that the fall of the country is too great for the slope of the canals, it will be necessary to build a number of drops in them. These drops are also necessary in order to avoid heavy rock-side hill work, but very little land will be lost by them.

Another canal line is proposed in order to avoid carrying the water any great distance. This is the lower line here [indicating on map]. This is the first one [indicating on map], and there is a still lower one below that.

Mr. BELL. I would like to ask you a question. How do you convert second-feet into acre-feet?

Mr. FITCH. You mean to convert second-feet into acre-feet?

Mr. BELL. Yes, sir.

Mr. FITCH. A second-foot is a cubic foot of water flowing by a given point in a second of time.

Mr. BELL. You say "492 second-feet." That is 492 feet a second?

Mr. FITCH. Flowing by in a second of time.

Mr. COOPER. The same as cubic feet?

Mr. FITCH. Yes, sir.

The CHAIRMAN. That is sufficient to irrigate about 35,000 acres on the basis of a cubic foot to 80 acres of land?

Mr. BELL. That is what I wanted to get at, a cubic foot to how many acres?

The CHAIRMAN. Eighty acres.

Mr. TIRRELL. How many feet would be required in this region? Is it a wet region?

Mr. FITCH. Yes, sir; that has not been investigated yet, but I think

here would be a high duty of water on account of its proximity to he mountains.

The CHAIRMAN. You measured this stream at its minimum flow?

Mr. FITCH. Yes, sir.

The CHAIRMAN. Long after the irrigation season?

Mr. FITCH. Yes, sir. Mr. Drummond in making the trip made it rom Billings, Mont., and followed the Big Horn River all the way p, and at this point [indicating on map] found there was a possiility of storing water on the Big Horn if it was ever needed below.

Mr. VAN DUZER. Regarding Montana, you said it might be possible or the Reclamation Service to reclaim about 2,000,000 acres of land t a cost of $50,000,000. If it were possible to develop and use all he lands in Nevada, how many acres could be irrigated? I want to et at the full capacity for development in the State.

Mr. NEWELL. The water supply of Nevada, as you know, is very uch smaller than in Montana, but by complete storage on the Carson, 'ruckee, and Humboldt we figure that upward of a million acres ould be reclaimed. That would mean a full development.

Mr. VAN DUZER. What would that cost?

Mr. NEWELL. Roughly, between $20 and $25 an acre.

Mr. VAN DUZER. Twenty million dollars?

Mr. NEWELL. Yes, sir; between $20,000,000 and $25,000,000.

Mr. BELL. There are over a half a million acres on the Humboldt?

Mr. NEWELL. There is a very large amount of water very badly sed, and it would necessitate a somewhat radical readjustment of the resent system.

Mr. VAN DUZER. The same conditions would be found in the Waler River proposition?

Mr. NEWELL. Yes, sir. By storing it on the headwaters we could evelop a larger area of land.

Mr. VAN DUZER. Two hundred and fifty million dollars would ractically complete—that is, in the full sense of the word—the work f the Reclamation Service? What I mean is that the investigations ade by you up to the present time—a good many could not be underken for some years—contemplate about $250,000,000?

Mr. NEWELL. That is just like making an estimate of what it will ost to complete the city of Washington. In California alone, if we ook up the Sacramento and San Joaquin problems, they alone will ke a great many millions of dollars and a great many years to comlete, but ultimately it will be done.

Mr. BELL. There is more irrigable territory in California than here is in all the other Western States combined. We have two valys there which contain more irrigable territory than all the rest of he Western States combined.

Mr. NEWELL. I suggest that you call on Mr. Davis to speak on the Rio Grande situation and the international question on the south. We have already heard Mr. Lippincott on the international question n the north and Mr. Babb on the international question in Monana. Now, we have the larger question and one which has reached very acute stage on the Rio Grande, above and below El Paso.

STATEMENT OF MR. A. P. DAVIS, ASSISTANT CHIEF ENGINEER, RECLAMATION SERVICE.

Mr. DAVIS. Mr. Chairman and gentlemen of the committee, the Rio Grande rises in the State of Colorado, is quite a long river, and flows through the State into and through New Mexico and then becomes a portion of the national boundary between the State of Texas and the Republic of Mexico.

The waters are largely diverted in the San Luis Valley in southern Colorado, and tributaries coming in below increase the supply somewhat. The river is used for irrigation in the neighborhood of Albuquerque and Socorro and other small valleys down through the Territory of New Mexico, each enterprise, of course, requiring the full low-water flow obtainable in its locality, and there are at all points floods which go to waste that are not being utilized, as there is no storage of any great magnitude anywhere in that vicinity. There are a few small reservoirs in New Mexico and Colorado, but none of any large size.

The development of the flood flow of the Rio Grande has received attention for a great many years. Some of the early irrigation surveys were made on the Rio Grande in the investigation of reservoir sites at various localities, and about 1889 the question was taken up in regard to the settlement of claims to water in old Mexico.

The claim was made by the Republic of Mexico that lands which had formerly been irrigated had been deprived of their water supply during the dry season by diversion above in the United States, and claims for damages to a large amount were filed with the United States for that reason.

The International Water Boundary Commission made investigation of a reservoir site involving the construction of a dam just above the city of El Paso by which the flood waters of the Rio Grande could be stored and utilized. The dam was to be about 60 feet high. The valley opens out very wide, and the dam I speak of would flood, when full of water, an area of 25,000 acres, and in time of freshet it would flood, it is estimated, 40,000 acres. The Rio Grande has a capacity of 530,000 acre-feet, and the site was not adequate for the complete utilization of the average waste of the Rio Grande.

The CHAIRMAN. What was the capacity in acre-feet?

Mr. DAVIS. Five hundred and thirty thousand acre-feet. We have long records on the Rio Grande, and occasionally the annual discharge flowing past that point is considerably more than that, but the normal discharge is about 530,000 acre-feet, and sometimes it is below that figure.

The CHAIRMAN. That reservoir must have been very shallow?

Mr. DAVIS. Yes, sir; maximum depth 60 feet, and mean depth something like 20 feet. The possibilities of evaporation are very great, and it also had the complication that the waters of the Rio Grande are exceedingly muddy, and with a deposit throughout the 25,000 acres it scattered the mud in such a way that it was very difficult and expensive to sluice it out by any method that had been proposed, and also as the waters declined they would leave an immense area of mud uncovered just below the city of El Paso, and in the

ıdgment of the committee to which it was referred, at low water ı the reservoir the condition in the city of El Paso would be unanitary.

At any rate, those were the conditions involved. There are three ailroads built through the site. The Santa Fe for a distance of over 0 miles would be submerged by the construction of the dam, and of ourse it would have to be moved prior to this construction, and the ntire system of storage there would be very expensive, and one-half f that expense would be for the removal of railroads.

The storage of Rio Grande waters in any reservoir in the northern ›art of New Mexico necessarily involves leaving out an immense mount of drainage area. There are reservoir sites west of Santa Fe nd at various points, but that objection, together with some other ›bjections, make none of those reservoirs available or desirable in ny respect as a solution of the Rio Grande problem.

A small reservoir site was selected near Elephant Butte by a com›any called the Elephant Butte Dam and Irrigation Company and hey proposed to build a dam 90 feet high at that point. That would ive the reservoir about half the capacity of the international site. Immediate development was fought in the courts by the United States in the interests of an international complication, and their filng finally lapsed. They have done nothing and they have at presnt no legal rights upon the river.

Mr. BELL. That is the only case that has gone to the Supreme Court?

Mr. DAVIS. It has been twice to the Supreme Court and remanded ›ack for trial.

Mr. BELL. They held that to be a grant that would interfere with ıavigation?

Mr. DAVIS. I think no court held to that effect. I think the lower courts did rule against the United States and the Supreme Court emanded the case back for consideration. At any rate, they abanloned the claim at that point, so that two years ago investigations were begun to find out the best way of utilizing the Rio Grande's entire water supply, and surveys were made for a site somewhat beow the Elephant Butte site.

The CHAIRMAN. Those surveys were made under the Reclamation Service?

Mr. DAVIS. Yes, sir; they have been going on about two years, the engineer on the ground being Mr. French, and estimates of cost were recently gone over and adopted by the board of consulting engineers on the ground. The reservoir that would be formed by the dam would be 45 miles long and very wide and deep. The evaporation would be considerably less than half of that at the lower site. It being a long and deep reservoir, it becomes feasible to sluice out the mud. All the conditions show that it would be nine times as efficient as the same method in the lower reservoir.

The CHAIRMAN. Where is the Elephant Butte site located? Just indicate it.

Mr. DAVIS. Right opposite the town of Engle, where my pencil is [indicating on map]. The site we are speaking of is only a quarter of a mile below the Elephant Butte site, and will submerge the entire site that would be formed by the Elephant Butte dam, and a great deal more. It backs the water up to the point where the Santa Fe

leaves the Rio Grande at San Marcial. It does not submerge any railroad or any town. I think there are only one or two little houses on the site. There is one good house on the site.

The CHAIRMAN. Is that a reasonably good reservoir site from an engineering standpoint?

Mr. DAVIS. Yes; I think so.

The CHAIRMAN. How high?

Mr. DAVIS. The depth of water, reservoir full, would be 175 feet. The dam would be somewhat higher than that, and there is a natural spillway, by which the surplus water would run to waste without running over the dam and return to the river about a mile below the dam site. The depth of the foundation is about 60 feet, whereas at the international site is 80 feet. The history of the water supply there is more than ten years old—that is, we have a daily discharge record for a period, I think, of about twelve years—so that we can tell very nearly what would have been the history of any reservoir that would have been constructed at that site at that time, and to judge the future by the past we know what is likely to happen, and we also know that the lower reservoir would in that time have wasted more than half the water of the Rio Grande either by overflow or evaporation.

Mr. COOPER. In view of the claims made by Mexico and in view of the former legislation, would there be any additional legislation needed in order to carry out this project?

Mr. DAVIS. Yes, sir; legislation would be needed to carry out this project. A portion of the irrigable land is in Texas, where the reclamation act does not apply, and there is not enough land in New Mexico to take all the water supply. It is estimated that the water supply, based on past records as regulated by the proposed Engle reservoir, would serve 180,000 acres of land. There are about 90,000 or 100,000 acres of irrigable land in New Mexico in valleys below that reservoir. There are about 30,000 acres of irrigable land in the State of Texas above the city of El Paso, making 130,000 acres, and the other 50,000 acres could be irrigated below the city of El Paso. There are 70,000 acres of irrigable land in the State of Texas below the city of El Paso, and probably twenty or thirty thousand acres in the Republic of Mexico.

Mr. BELL. What was the purpose of this international dam, to supply the Mexican territory?

Mr. DAVIS. To supply the old water rights in both Texas and Mexico.

Mr. BELL. Was there any treaty on the subject?

Mr. DAVIS. Not that I know of, except the formation of this joint commission between Mexico and the United States to investigate the matter.

Mr. BELL. We have not bound ourselves to maintain that dam there with a certain amount of water?

Mr. DAVIS. There is no arrangement of any kind.

Mr. BELL. This work is purely voluntary?

Mr. DAVIS. It has not been done.

Mr. BELL. I thought it had been done.

Mr. DAVIS. No; it is simply a proposition that has been under investigation for about twelve years.

Mr. BELL. And this commission proposed to do that and reported favor of it?

Mr. DAVIS. Yes, sir; assuming the same duty of water from the ver reservoir as from the upper, the lower would water 55,000 es and the upper 180,000 acres.

Mr. VAN DUZER. And the cost per acre?

Mr. DAVIS. About $40. That is $7,200,000 for the whole project. at includes everything down to the city of El Paso and sufficient ter to water 50,000 acres on either side of the river, and that ludes the distribution above the city of El Paso.

Mr. BELL. You will have to have legislation similar to the Kla- th proposition to permit you to interfere with navigation on the o Grande?

Mr. DAVIS. I would not think so myself. Not being a lawyer, I not competent to speak; but the Rio Grande is not a navigable eam at this point.

Mr. BELL. I think the Supreme Court decision is only two or ee years old. The Supreme Court held that it was navigable and testimony showed that up to a certain point it was.

Mr. DAVIS. It is to a certain point, but this would not interfere th navigation, in my judgment.

Mr. NEWELL. It has been remanded back on a question of fact, d when it comes to a question of fact I think we can meet it.

Mr. DAVIS. On the same duty of water estimated for the two ervoirs, the upper one, 180,000, and the lower, 55,000 acres, that due partly to the great efficiency of the reservoirs and apparently the greater water supply, and of course that additional water pply is taken from what is now used, but that is of such a character t it is expected, and we are perfectly confident, that all the lands ng that water are perfectly willing, in view of the benefits to be rived from a permanent supply, to surrender the water they now .

Mr. WILLIAMSON. What is the altitude?

Mr. DAVIS. I do not know what the altitude is at El Paso.

Mr. NEWELL. About 3,000 feet.

Mr. WILLIAMSON. And what is the height of your dam site?

Mr. DAVIS. It is not over 200 feet higher.

Mr. TIRRELL. This is one of the most expensive propositions that have heard.

Mr. DAVIS. Yes, sir; and it is in a peculiar form.

Mr. TIRRELL. Forty dollars an acre is the highest price we have ard.

Mr. DAVIS. We have other projects under consideration of higher ice, but this is the highest price of any one project that is consid- d feasible at the present time.

Mr. WILLIAMSON. What are the chief products along that line?

Mr. DAVIS. They are valuable. It is an excellent country for aches and grapes, in fact all kinds of temperate-zone fruit and alfa.

Mr. VAN DUZER. Do they raise cotton there?

Mr. DAVIS. Yes, sir; they have not raised it in this immediate ality, but they have on the Pecos, in the same latitude, and they ve found it very successful.

The CHAIRMAN. You have not taken into your examination the claims of Mexico?

Mr. DAVIS. No, sir; we have not considered them.

The CHAIRMAN. I understand there was a resolution passed at the irrigation association at El Paso in regard to the division of water. What was that resolution?

Mr. DAVIS. They simply passed a general resolution approving of this project because it afforded a means by which a settlement could be obtained. That resolution simply meant burying the hatchet by two communities that had been at sword's points for many years on this subject, the El Paso people being in favor of the lower dam site because of irrigation around that city, while the Las Cruces Valley wanted a reservoir above them, and were in favor of the Elephant Butte project, each one fighting the other's proposition. The El Paso community were supposed to be antagonistic to anything higher up until it was shown that it would be equally as beneficial to them as the international dam, and then simply to be on record these resolutions were passed by the El Paso people and all the people there combined.

The 25,000 acres submerged and the 40,000 acres submerged at flood time by the lower reservoir is American land, nearly all of which if irrigable, and part of it is irrigated, would be just as valuable as any other. Of course, in its raw state, without irrigation, it is not very valuable, but some is irrigated, and the land damages would be very high.

Mr. BELL. How wide will be the reservoir at Elephant Butte?

Mr. DAVIS. Very narrow. The boundary lines are exceedingly crooked. There is no valley land there to exceed a mile in width, and very little that wide, and I presume there is less than a thousand acres of good agricultural land submerged. The total top width of the reservoir would be 4 or 5 miles, as a rule. It is not a valley reservoir in any sense. The very low fall of that river is the reason for the great capacity. The river falls about 4 feet to the mile, and 175 feet of water depth backs that water something like 45 miles. Of course, on a straight line it is shorter, something like 40 miles.

The CHAIRMAN. What other projects do you propose to have Mr. Davis discuss?

Mr. NEWELL. That was the principal project. I suggest that the opening of a project in New Mexico, the Hondo River, be discussed by Mr. Sanders, who has recently been down there.

STATEMENT OF MR. W. H. SANDERS, CONSULTING ENGINEER, RECLAMATION SERVICE.

Mr. SANDERS. Mr. Chairman and gentlemen of the committee, the project that is assigned to me to present to you, the Hondo, is in the southeastern part of New Mexico and is one of the small projects that has been under consideration. The lands that are to be irrigated are in the immediate vicinity of Roswell, and it is a very fine body of land. The products of this section of the country are alfalfa, apples, and the crops that are commonly raised in the Temperate Zone. It is an exceedingly fine alfalfa and apple country. One of the largest apple orchards in the United States, of about 1,500 acres, is in that

nediate vicinity, the Hagerman orchard. The land in that sec-
ı is much in excess of the water supply. The water supply is
n the Hondo, one of the tributaries of the Pecos River, into which
mpties at or near Roswell.

'he Hondo rises in this range of mountains [indicating on map],
Sacramento Mountains, nearly west of Roswell, and flows in a
therly course and empties at this point [indicating on map].
ɜ low-water flow of the river is entirely appropriated and used.
ny of the lands that have been irrigated in the past are now arid
ds, owing to insufficiency of the normal flow, and, as I have said,
s the flood flow that we contemplate to use. The reservoir is a
ıll reservoir on the Hondo, about 12 miles from Roswell, and is
ıated in a small valley surrounded by low hills. Its capacity is
)00 acre-feet of water. The quantity of land that the board has
sidered that we can irrigate from this source is about 10,000 acres.

Ir. WILLIAMSON. Is that public land?

Ir. SANDERS. All private lands, sir. The lands under this canal
all that the board considered can be irrigated from this source.
ere are no engineering difficulties whatever. The dams are low,
ut 24 feet being the maximum at the outlet dam. A small diver-
ı there just immediately above the reservoir, about 2,600 feet,
pties into this reservoir site and is held there until the irrigation
son.

'he CHAIRMAN. Do you propose a diversion of these waters to
er lands now not under ditch?

Ir. SANDERS. A small portion, but the larger portion is under
ch at present.

'he CHAIRMAN. This project is not a project for reenforcing the
sent supply for irrigated lands, but with a view to bringing addi-
ıal lands under irrigation?

Ir. SANDERS. It reenforces lands now under irrigation and also
ngs under irrigation additional lands—a very much larger body of
d that is not under irrigation.

'he CHAIRMAN. Of the 10,000 acres that you speak of, how much
that would simply be reenforcement of the present supply and how
ch of it would be new land not now irrigated?

Ir. SANDERS. A very small portion is to reenforce the lands that
irrigated from the present source, from the normal flow. A very
all section of the whole tract, distributed throughout the whole
a, is under the project.

'he CHAIRMAN. They have no water supply at all at present?

Ir. SANDERS. No, sir.

'he CHAIRMAN. They have never attempted to secure a water sup-
?

Ir. SANDERS. I think not; there has not been sufficient water.

'he CHAIRMAN. Is your dam site a feasible one?

Ir. SANDERS. We consider it so. It has been considered by the
ole board.

'he CHAIRMAN. Are there any serious engineering difficulties?

Ir. SANDERS. None at all. Of course, we apprehend some diffi-
ties; they were considered.

'he CHAIRMAN. What do you estimate the cost of that project?

Ir. SANDERS. I am not able to give it to you.

The CHAIRMAN. You have not reached that point?

Mr. SANDERS. Yes; we have reached it and the contracts have been awarded.

The CHAIRMAN. Have the contracts for the construction of the dam and the canal been awarded?

Mr. NEWELL. The contract for the dam has just been awarded by the Secretary.

Mr. DAVIS. The contract is for $160,000, and the estimated cost of the total project is $280,000.

The CHAIRMAN. And that project will irrigate 10,000 acres?

Mr. SANDERS. Yes, sir. All the contracts awarded run below the estimates of the engineers.

The CHAIRMAN. I wish to state here that I am glad to see the service taking up some of the small projects that can be carried out at reasonable cost and can be completed.

Mr. SANDERS. We had hoped that this would be the first project completed, but certain little complications arose that for a short time delayed it, but now everything is in working order and in a very short time the water will be turned upon that land. I will just say that this flood flow that comes from the Hondo is very considerable in the immediate vicinity and that in Roswell the water has passed through the streets up to about 3 feet in depth. Roswell is a beautiful city of about 4,000 inhabitants; it is a modern city, and it is intended to irrigate this land and also to prevent those occurrences. This is one of the most desirable tracts that was examined in 1902 for irrigation purposes.

Mr. WILLIAMSON. What is the altitude in that section?

Mr. SANDERS. About 5,000 feet.

Mr. TIRRELL. The price is not very excessive?

Mr. SANDERS. No, sir; it is low. The amount of water stored is 40,000 acre-feet and the duty of water in that immediate vicinity is about 13 inches for alfalfa, 12 inches for apple orchards, and, of course, the other crops correspond. When you raise beets it is very much less. There has been a very careful record kept for several years of the water used on the Hagerman ranch, and the water necessary to raise a first rate crop in Pecos Valley is 16 acre-feet the second year. Mr. Hagerman took up the beneficial use of water and has shown what can be done by careful management, that the maximum 2½ acre-feet is sufficient for an alfalfa crop.

Thereupon, the committee adjourned to meet on Friday, January 20, 1905, at 10 o'clock a. m.

COMMITTEE ON IRRIGATION OF ARID LANDS,
HOUSE OF REPRESENTATIVES,
Washington, D. C. January 20, 1905.

The committee this day met at 10.30 o'clock a. m., Hon. Theodore A. Bell in the chair.

There appeared before the committee Mr. F. H. Newell, chief engineer of the Reclamation Service, accompanied by Mr. Arthur P. Davis, assistant chief engineer; Mr. J. B. Lippincott, supervising engineer; Mr. H. N. Savage, supervising engineer, and Mr. C. J. Blanchard, statistician.

Mr. NEWELL. Mr. Chairman, if your committee has no objection, I ill ask Mr. Lippincott to talk to you about the Sacramento Valley roject. I think everybody here will be interested in that.

Mr. BELL. Yes. I am very sorry some of our other members are ot here, because I may want them to have something to say with reard to that bill of mine if it should be necessary.

Mr. NEWELL. Perhaps Mr. Davis could talk first, and then the Sacmento matter could be taken up later.

Mr. BELL. I think that would be well.

Mr. VAN DUZER. Mr. Newell, in what shape does the Secretary ow place our Walker River project? I understand he has set apart 200,000 from the Truckee-Carson project.

STATEMENT OF MR. ARTHUR P. DAVIS, ASSISTANT CHIEF ENGINEER.

Mr. DAVIS. The Secretary approved the recommendation, and ated in his letter that he had sent a copy of his approval to Senator Iewlands, who initiated the recommendation.

Mr. VAN DUZER. What is the status of that matter as it now tands?

Mr. DAVIS. It is in the hands of Mr. Taylor, in charge there, and e is instructed to go ahead. The recommendation made, which was pproved by the Secretary, involved a number of conditions which it ould be necessary for the people to fulfill there in order to comply ith the law.

Mr. VAN DUZER. No, they have not settled their litigation.

Mr. DAVIS. I do not think the recommendation said anything about he litigation—that is, so far as I understand. It is only necessary, ccording to the Secretary's letter, to have them enter into a watersers' association, in which all interests would be combined, and then o surrender their water rights and canals for this use, so as to obliterte all sources of friction and to guarantee the returns under the onditions of the reclamation act at cost.

Mr. VAN DUZER. Now, a desirable condition precedent there is hat the whole thing shall be supposed to be settled before anything efinite is undertaken?

Mr. DAVIS. Yes.

Mr. VAN DUZER. They have not all the information necessary now?

Mr. DAVIS. Not all. We have to make some special investigations n order to get ready for construction. If the people are reasonably rompt and active there will be no unnecessary delay. I think we an get ready for construction in two months.

Mr. VAN DUZER. I am anxious to get those people out there to ppreciate the gravity of the situation and get together.

Mr. NEWELL. That is the great thing—to hold out the opportunity o settle all their controversies and come in on an equitable basis. Iust as soon as they do their part we are ready to help them out.

Mr. VAN DUZER. You say you will begin construction in the course f a couple of months?

Mr. DAVIS. I do not think that we can begin quite that soon. Of ourse, original construction can not really begin just then, because,

as a matter of fact, after you get ready for construction it takes about four months to actually begin.

Mr. VAN DUZER. What does that contemplated work comprehend; the building of a dam?

Mr. DAVIS. No; the diversion of Walker River to the Alkali Lake for storage purposes, and the making of an outlet tunnel back into the Walker River.

Mr. VAN DUZER. This will be the completion of a preliminary unit in the ultimate development of that project?

Mr. DAVIS. Yes. It is a portion of the whole thing, an absolutely necessary portion of the ultimate development. The only thing we build is simply one small reservoir to take care of the land now under cultivation.

Mr. VAN DUZER. You have been there, Mr. Newell?

Mr. NEWELL. Yes; it is a beautiful scheme. We can take it up and complete it now, and stop all the controversy, and the great loss of money and time from the people fighting each other.

Mr. VAN DUZER. How many acres really on Walker River will be eventually utilized?

Mr. DAVIS. Something over 200,000 acres.

Mr. VAN DUZER. That evidently takes in all that country down there toward the Indian reservation?

Mr. DAVIS. Smith Valley and Reclamation Valley are the principal tracts. There is something like 20,000 or 30,000 acres now under cultivation involved in this litigation—between 15 and 20 per cent of the whole.

NORTH PLATTE RIVER IN WYOMING AND NEBRASKA.

Now, Mr. Chairman and gentlemen, the North Platte River is an interesting stream. Some of its branches rise in Colorado and some in Wyoming, and flowing from those States into Nebraska, and finally emptying into the Missouri River. The land now cultivated by irrigation from the North Platte River amounts to about 107,000 acres, mainly in Nebraska. A portion of that, however, is in Wyoming.

Mr. REEDER. Let me ask you this: Is the land which is irrigated in Nebraska in that section now subject to the 640-acre homestead?

Mr. DAVIS. Yes, sir; it is in a portion of the State where the law applies, but the land that can be irrigated has been withdrawn, and has thus been prevented from becoming subject to the law. The water supply of the river is like that of all other streams that rise in the Rocky Mountains, fluctuating and different at different times in the year. The time of the melting of snow, mainly in May and June, is the time when the river is in flood. Those floods run off with great rapidity, and in the latter part of July the river goes down to a very much lower stage, and in August still lower, while in September it is still lower yet. In the irrigation of this land which I speak of, the water supply is ample until about the middle of July. At that time the level goes down at about the rate of 700 cubic feet per second, and yet no serious difficulty is ordinarily felt until August. In August there is always a shortage of water over the land now under cultivation. In September the shortage is still greater.

Mr. REEDER. I want to ask. Is there any perceptible difference in the

flow of that river in what is called the "dry season," from what there was fifteen or twenty years ago?

Mr. DAVIS. We have not the records from which that question can be answered; but there is no question in my mind but that that is the fact. The records are not available, however.

Mr. REEDER. When we were in Colorado two or three years ago Professor Carpenter made some statement there as to that point, and thought they had the records, as I understand it, running back over the past fifteen years.

Mr. DAVIS. Yes.

Then, on the South Platte River—this is the North Platte that I have referred to just now, but the facts obtained there are just the same. There are a number of canals diverting the North Platte River, mainly in the State of Nebraska, and there is a new one under construction now being built under the provisions of the Carey law, heading at this point in Wyoming [indicating on the map], and taking land for irrigation down as far as the State line here [indicating]. The Platte Canal is now constructed to this point [indicating], what is called the Raw Hide Creek or Valley.

There is no further considerable irrigation development possible on the North Platte without storage; and under the existing shortage of water in the latter part of the season every year, any of those lands placed under irrigation, of course, become competitors for the low-water flow, and there has already been very considerable litigation in the valley on account of the present interests there.

In the further development of that valley then, of course, the reclamation service has made the first investigation, that of storage possibilities; and considerable investigation along that line has been made, and a thorough reconnaissance along the basin has been made. One site at Davis Cut has been very thoroughly investigated and the water supply found insufficient, together with some other difficulties; but an excellent reservoir site has been discovered, which involves the construction of a dam just below the mouth of the Sweetwater, about 55 miles west of the end of the Chicago and Northwestern Railroad. Borings have been made, and surveys as well, to find the foundations for the dam, and we have one of the finest reservoir sites there in the West. It not only lies between walls of granite, but it is exceptional also in the excellent opportunities it affords for foundations. The borings have been made very completely there, and the gravel overlies the base rock nearly 5 feet in the deepest places, so that we have solid granite for the foundation and excellent granite abutments.

The limit of height of that feasible dam there is 210 feet. That height will furnish a storage capacity of more than a million acre-feet, which will practically control the entire flow of the North Platte River in ordinary years. It is very doubtful if that reservoir could be filled in the years of least running off from that basin, so that we have a very satisfactory and complete solution of the storage problem on the North Platte River.

Mr. BELL. How far is that from the public land?

Mr. DAVIS. About 200 miles from this region, where it would be used. By the curvature of the stream it is about 250 miles from the town of Casper, the end of the Chicago and Northwestern Rail-

road. I think by the curves of the stream it is in the neighborhood of 200 miles from there. There are numerous small tributaries of small discharge coming in below that point, and even when the reservoir is entirely closed the stream will not be entirely dry very much of the time, so that the requirements of seepage and evaporation are met from other sources, and we will not have any considerable loss, we think, from the reservoir water in running down from this point.

Then investigations have been made for the area upon which to apply this water, and those investigations have extended over more than two years. They began shortly after the passage of the reclamation act, in fact, and have resulted in obtaining a large amount of information, which is illustrated on this contour map of that country [indicating].

The first project investigated is what is known as the "Goshen Hole" diversion. This dotted line [indicating on map] on the south side of the hill represents roughly the proposed course of that canal. That waters lands on the south side of the river and requires the construction of a diversion dam about 90 feet high at that point or thereabouts, which would form a lake in the river represented by the blue coloring [indicating on map]. There is a very slight change necessary in a small branch railroad for that improvement, and borings are now in progress to determine the foundation. We have not completed those borings, but we know the foundation is very deep.

Mr. COOPER. You would have to construct the canal all the way to carry this water?

Mr. DAVIS. Yes.

Mr. COOPER. What would be the length of that canal?

Mr. DAVIS. About 200 miles.

Mr. COOPER. Would there not be a great loss of water off that canal?

Mr. DAVIS. Yes; considerable loss; but the country is not unfavorably situated for that.

Mr. COOPER. What form of construction have you in mind in order to conserve the water?

Mr. DAVIS. No special form has been proposed here. The canals will probably be built of two sections and made deep and not too wide, having a minimum perimeter. The first 30 miles of this, down to that point [indicating], is quite rough. There is considerable rock, and altogether about 6 miles of tunneling will be required in soft sandstone rock. However, the irrigable land begins nearly at the head of the ditch and goes on until this point is reached [indicating on map], scattered along there in these various valleys.

Mr. COOPER. The loss of water along the canal would operate also to irrigate incidentally to the same effect, would it not?

Mr. DAVIS. Yes, to the same effect, but not to a very important extent. But there would be land that would be benefited somewhat from the seepage of the canal.

After reaching this point [indicating] the canal starts from the river, and the lands under it are very extensive and fine. The Goshen Hole lands are without superior, we think, in the arid region. Altogether about 150,000 acres of land could be covered by that line.

That was the first project for the development and application of he North Platte water that has been mapped out. There was coniderable heavy construction, and it figures up to a cost of between 35 and $40 an acre; and that was not considered feasible if it had o stand the entire charge for the storage reservoir, which is over a illion dollars at the Pathfinder site.

Mr. VAN DUZER. Where is that?

Mr. DAVIS. It is about 55 miles above Casper, on the North Platte. Casper is the end, as I said before, of the Chicago and Northwestern Railroad, and is, roughly speaking, 200 miles from the State line.

Mr. VAN DUZER. I notice there are wide, sandy bottoms there. Does the water disappear from sight? Is there an underflow there?

Mr. DAVIS. Yes; the water disappears. The river is of a decidedly lifferent character from what it is down in Nebraska. It is very uch wider and shallower down below. It becomes of a deltaic haracter down below.

Mr. VAN DUZER. Where is most of the land to be irrigated in that roject situated—in Wyoming?

Mr. DAVIS. The project has most of the land in Wyoming; yes, ir.

Now, there is another investigation that has been carried on, and hat diverts the water without the assistance of the high dam near he river level at this point, and carries it along the line indicated in lack here [indicating on map]. A small canal has been built a porion of the way for the irrigation of the lands in Wyoming, along here [indicating], but our surveys have shown that a large canal uilt on a lighter grade than that could continue along approximately he lands indicated by these dotted lines [indicating], away down in Nebraska.

Mr. VAN DUZER. What are those colored portions?

Mr. DAVIS. This is simply a monthly progress report of the topographic department. We have made an outline survey to outline the listribution system and lay out the construction of the project.

The construction of this north side canal has been pronounced easible, and we are now almost ready to let contracts upon that side. The irrigable land has been surveyed on a scale of 1,000 feet to the nch, and that is what leads to this coloring [indicating on map]. There are some reservoirs that can be used for the discharge of the vaste water in this canal and for the reception of water coming down n the nonirrigating season.

Mr. COOPER. Are you satisfied that there is water enough above here to supply all this country down here that you speak about?

Mr. DAVIS. Yes. The two projects I have described supply, all old, something over 300,000 acres of land. We have a million cre-feet capacity in the storage reservoir, and of course a surplus f water in the month of June aside from that, and it is regarded s an ample water supply.

Mr. COOPER. The season is rather short, is it not?

Mr. DAVIS. Yes; it is rather short, lasting for about five months.

Mr. WILLIAMSON. Those lands are almost wholly private, are they ot?

Mr. DAVIS. No. On the Goshen Hole side they are nearly all ublic land. On the north side the project has laid out, perhaps,

about 85,000 acres of public land and about 15,000 acres of private land—that is, at present, above present abridgment ditches and about 16,000 acres under abridgment ditches. About half of the land is public and about half private land. It is not contemplated to water very much of that—a very large amount of that private land. Between 80 and 90 per cent of the project is public land. There are private filings on these lands; but as I have described in opening, the season of the water supply over the land now cultivated is very short in August and September, and if any considerable amount is added to these areas the shortage would be very much greater.

There is no possibility of giving an ample water supply to the lands now cultivated or of materially adding any area to these lands for cultivation without storage. And I might say here that some controversy has reached the ears of members of Congress, and a question would possibly be asked by Mr. Mondell if he were here in regard to that. A private company has bought up what is known as the "farmers' canal," which heads at the State line here and follows the blue line [indicating] until somewhere about here [indicating]. It is simply a small canal, and then a survey extending it very much farther has been made to include a large area of other lands, which are mainly private lands. The company purchasing that canal is a strong corporation which started in with the plan of purchasing all the canals practically along the north side of the river and purchasing all the lands under them.

That corporation has purchased this one canal and some interests in other canals, and purchased in fee simple about 40,000 acres, and it has been endeavoring to increase those land purchases largely. But when the surveys of these north side Government lands were pushed along to a certain extent and began to look feasible—and a work so pushed, of course, has attracted public attention—it became more difficult for the corporation to acquire these public lands, because people conceived a hope of obtaining water from the Government canal. That has led to charges from this corporation that the Government has been promising those people water. It is not a fact. The promise has not been made, and the charge is made, based probably on the fact that when questioned as to the use of seepage water out there the answer of the engineer has been that while the lands are now covered by this private corporation, probably some arrangement can be made for the irrigation of these lands by the Government. However, that is subject to some future arrangement that may be made, and is no real basis for a promise, and no such promise has been made.

The small canal I refer to, heading at this point [indicating], is called the Whelan Falls Canal, and is being constructed under the Carey Act, and is partially completed to that point. In some portions the bank has been blown away by the winds and there are no adequate headgates. That canal has recently been acquired by the United States, nominally by purchase, but the acquisition was only desired in order to use its right of way, its filings, and water rights covering these lands; and the right of way is now occupied. That same right of way is absolutely necessary for the Government canal. It is right at the foot of the bluff. It can not be built sufficiently lower to avoid interference with that canal. It is different on the lighter grade. For a great distance, therefore, it is necessary to

occupy the same right of way, and negotiations were inaugurated by the Secretary of the Interior and brought to a successful conclusion by which that company surrenders its right of way in consideration that the Government will maintain the canal along there and allow them to use it—in consideration of the fact that the Government will construct a canal large enough to allow this company to use such water as it is entitled to.

I do not know how far it is perfected, but I think to that point [indicating on map]. Beyond that there are no other obstacles, as the canal is practically upon Government land. The whole thing is fairly worked out, and the storage reservoir has been brought to a point where bids have been opened on the outlet tunnel, which is preliminary to the construction of the dam. I believe the contract has not yet been awarded by the Secretary of the Interior, but the lowest bidder was Kirkpatrick & Collins, contractors, of Beatrice, Nebr. The contract requires that the work shall begin promptly on that outlet tunnel, which is necessary for the diversion of the river during construction, and is preliminary, as I say, to the construction of the dam. It is expected that plans for the dam will be completed, and advertisements will be made partly for the construction of the Pathfinder reservoir, which will require two, or possibly three, years for completion; and by the time that would be completed, so that there would be an available water supply, it will be entirely feasible to complete this canal and put the land under irrigation, and by an even distribution of the cost it is now thought that it will be feasible to build a high diversion dam at that point and bring the land in the Goshen Hole under irrigation.

Mr. BELL. In what State are these Goshen Hole lands situated?

Mr. DAVIS. In Wyoming. There are also, perhaps, 12,000 acres or so of land under that project in the State of Nebraska.

Mr. BELL. But the major portion of it is on the Wyoming side?

Mr. DAVIS. Yes, sir; on the north-side project the major portion of the lands is in Nebraska and the smaller portion in Wyoming.

(At this point Mr. Bell vacated the chair and Mr. Tirrell assumed it.)

Mr. MARSHALL. What is the net amount of the contract bid for that work?

Mr. DAVIS. It is within 1 per cent of the estimate. The highest bid was something like double the estimate. The lowest is under the estimate by a few hundred dollars.

Mr. BELL. Now, Mr. Newell, I think we would like to hear something about the Sacramento Valley, as you suggested, and as Mr. Lippincott is here.

Mr. NEWELL. Mr. Chairman, at the suggestion of Mr. Bell, Mr. Lippincott will speak of the Sacramento project. It will take about half an hour to discuss that subject.

Mr. BELL. I would state, Mr. Chairman, that we thought we would like to have a discussion of the possibilities of the Sacramento Valley, for the reason that I have introduced a bill which is general in its character, but which might be construed to have almost special reference to conditions in the Sacramento Valley. The bill will be before this committee soon, and I thought it would be a good idea to have some light thrown upon the subject.

STATEMENT OF MR. J. B. LIPPINCOTT, SUPERVISING ENGINEER.

Mr. LIPPINCOTT. Gentlemen, I wish to say that Mr. Bell and the chief engineer have handed over to me the problem of describing what is probably one of the most intricate and extensive projects under consideration in the entire arid region. Am I [addressing Mr. Savage] going to interfere with your time?

Mr. SAVAGE. That depends upon the length of your statement.

Mr. MARSHALL. The committee can sit until 12 o'clock, Mr. Chairman, can it not?

Mr. TIRRELL. It has been sitting sometimes until half-past 12.

Mr. LIPPINCOTT. The Sacramento Valley is the northern portion of what is generally known as the great central valley of California. It lies in the northern portion of the State, and practically drains the entire northeastern quarter of the Commonwealth. On the west of the Sacramento Valley there is a range of mountains, generally called the Coast Range. That range varies in elevation from 3,000 feet to 6,000 feet. These mountains serve to arrest and hold a great deal of the moisture that is carried by the winds from the Pacific Ocean in their easterly journey across the continent. Immediately to the east of the Coast Range lies the Sacramento Valley, which is at sea level at its southern end, having tidal water, and at its northern end, near Redbluff, if I remember correctly, the elevation is but 400 or 500 feet.

This great central valley of northern California contains about 2,500,000 acres of agricultural land. The existence of the Coast Range between this plain and the ocean deprives the valley of a great deal of the moisture which otherwise might be deposited there, and gives it a condition of semiaridity. The rainfall varies from 12 inches on the western side of the valley to perhaps 17 inches on the eastern side. At the northern extremity of the valley we have the great Mount Shasta, with its perpetual snow and glaciers, arising to an elevation of about 15,000 feet. On the eastern side of the valley is the Sierra Nevada, with elevations of 10,000 and 12,000 and 14,000 feet. These Sierra Nevada Mountains and Mount Shasta are the condensers that divert or extract from the moisture-laden winds on their way to the sea the greater portion of their humidity, and they form the catchment basin from which the great streams entering this valley flow.

Because, therefore, of the topographical conditions in this section, we have on the lower Coast Range a heavy precipitation of moisture, with resulting winter and early spring floods. That is a very important factor in this case, that the streams proceeding from the Coast Range on the west have early spring floods and winter floods, because of the low elevation of the mountains.

On the easterly side of the valley, where the elevation is very much greater and the precipitation largely in the form of snow, the streams run off naturally from these higher elevations during those cold months when the temperature is very low; but when the early spring and summer weather comes we have a melting condition of the snow, and a consequent flooding of the streams during the latter part of May and the first of June or July.

The Sacramento River receives these tributaries from the right and left, and flows through the entire length of this valley, and is prac-

ically navigable for the entire length of that valley. Steamboats are ommercially carrying freight as far north as Red Bluff, which is the orthern end of this basin.

We have, in the northern section of the valley, a great flat, and durıg the annual floods of this river, frequent in February and March, ;e have a great flood, projected through this drainage mountain asin, discharged into the river, causing the river to overflow, partly ecause of the débris carried down from the mountains, and partly ecause the channel is normally too small; and on that account we ave a great condition of flood in the lower regions of the valley, as ıdicated by the shading on this map [indicating]; and during the oods of last February we had over 800,000 acres of these valley lands overed with water.

We therefore have a number of important problems in connection ;ith the adequate development of this section. In the first place, we ave navigation interests to promote and to develop; we have the wamps and overflow conditions of these valley lands to contend ;ith, and we have to look for their preservation from overflow partly ɔ levees.

I am not claiming that the reclamation service proposes to build hose levees, but that is one of the physical problems connected with hat project.

Then we have the arid conditions of that valley, without any rainıll practically from the 1st of April to the 1st of November, calling ɔr an adequate irrigation system. This great problem of the Sacraıento Valley has not been fully worked out by the Reclamation Servɜe, and all I can say on the subject this morning is simply to make a rogress report of that work which we have thus far carried on.

Appreciating the magnitude of the problem, the people of Califoria, by urgent petition to the Geological Survey and to State officials, ave provided for a joint investigation of the natural resources of ıe State, and particularly of the Sacramento Valley, between the tate of California, the Geological Survey, and the Bureau of Forɜtry, and some departments of the Agricultural Department.

The plan that was outlined was somewhat as follows: The great ɜgulator of the flood discharge of all these rivers is the forests. The ɔrests are being rapidly destroyed through being overgrazed. Conɜquently it was necessary to consider the forest regulation of these ;reams by an adequate protection of these forests, as well as the con;ruction of levees and the deepening of the river channel. So the ;ureau of Forestry was requested to thoroughly explore the timɜred portion of that drainage basin to formulate plans for the withrawal of forest reserves, and to form a code of State forest laws. 'ractically the entire drainage basin from the inner arm of the bay lear up to Mount Shasta has been temporarily withdrawn, pending ıvestigation for the forest reserves; and on the one side of the Sacıamento Valley, in a basin of proper character, a forest reserve was reated, and, as I say, a code of forestry laws has been submitted to ıe California legislature by Mr. Pinchot, and is now under serious dvisement by that body to-day.

Now, we desire to know accurately the topographical conditions of ıat plain and valley, so that we could consider jointly the overflow roblem in connection with the construction of levees that might be

necessary, and also the irrigation problem in connection with the distribution of water.

I have here a map [producing same] which has been prepared under this cooperation work. On one corner it bears the inscription of "George C. Pardee, governor," etc., and on the other corner it bears the name of the Geological Survey, under the Director, Charles D. Walcott. This shows the method we are following out in connection with the examination of the topographic features of that valley.

These two sheets that have been so surveyed are in the upper portion of the Sacramento Valley, and are the small school maps that are generally used by the Department [producing map]. These surveys, really, are being carried out with greater accuracy than would be indicated by that small map. We have here one of the larger sheets reproduced on the full-size scale of our field work, showing a section of the upper portion of the Sacramento Valley.

These contour interval lines [indicating] or level lines are only 5 feet apart, and they show with great accuracy all the detailed undulations of the surface of the ground and will admit not only of the location of the main canals, but of the distribution system with great accuracy, and their production will avoid or make needless all the detailed work that engineers usually have to do in laying out the lines.

The straight line you see on the map [indicating] shows the projected head of the old irrigation district started in 1890 under the California law, which contemplated the diversion of the Sacramento River. That is an interesting thing from two points of view. In the first place, it shows an effort that has been made on the part of the State to solve the irrigation problem in the Sacramento Valley—an effort that resulted in disaster, from a variety of reasons or causes. The problem apparently was too great to be solved by the methods provided. The plan was that the cost of the work was to be defrayed by the issue of interest-bearing bonds, which were mortgages on the land.

Again, the army engineers, in reviewing this project, required that the grade of that canal should be so constructed that the water could not be diverted from the Sacramento River except when it was in its highest stage, because if such diversions were made it would interfere with the navigable capacity of that stream. So you will see that that has an important bearing on other subjects that I will attempt to bring out.

The reclamation service, as their part of its work, has begun the general exploration of the entire drainage basin of the Sacramento River, looking for reservoir sites. We have begun on the lower left-hand corner of the basin and have proceeded now up to the westerly side around the northern side and made a general reconnoissance of the eastern side of the basin. We have found to a remarkable and surprising extent great reservoir sites on practically every tributary of that stream. We have found, for instance, on Putah Creek, a reservoir whose capacity is greater than the flood discharge of that stream.

That may also be said of Cache Lake and of Clear Lake. On Stony Creek we have found four reservoir sites. On the upper Pitt River we have found more reservoir capacity than the Pitt River

can fill, and with the exception of the main Sacramento River and the McCloud River, which I should have excepted before, we have found these great river reservoir sites on all those streams, and we know that greater reservoir sites exist on the headwaters of the Feather River and the larger streams on the eastern side of the basin.

Now, the theory that we are proceeding on is that that entire problem of forestry irrigation and drainage and prevention of overflow should be considered in one harmonious whole and that plans should be formed for that great Sacramento Valley looking toward the ultimate development of it by using all these natural resources on some prearranged and comprehensive plan.

We believe that a great canal should be ultimately constructed down either side of this basin, and during the spring and early summer an adequate supply of water can be obtained for that canal by a direct tunnel of the Sacramento River at the diversion of that stream at Red Bluff. We believe that the navigation of that stream should be promoted, and that following the flow of the main river below a fixed point, we should draw on these storage reservoirs which surround the valley to sustain the irrigation water supply for these irrigation canals throughout the main portion of the year.

Mr. COOPER. You think there is an abundant supply of water there to irrigate that whole valley? It is only a question of control and distribution.

Mr. LIPPINCOTT. Yes, sir. The record has been kept for ten years of the lower floods of the Sacramento River, and we find that the average discharge of that river was 25,000,000 acre-feet of water. Now, the area of irrigable land in the entire valley is 2,500,000 acres, so that there is a great excess of water. We have an unusual condition—an excess of water supply.

Mr. MARSHALL. Would you need these embankments if you had the reservoirs?

Mr. BELL. I would want to go into that a little more fully—how far you could control these floods by reservoirs, and whether to any appreciable degree——

Mr. LIPPINCOTT. I wish I could answer that question more definitely than I can. When I left California, about the 10th of December, I put an engineer to work upon that problem, and he has just finished that work, but I have not yet got his report.

Mr. BELL. I want to ask you some questions here on the map.

Mr. LIPPINCOTT. But I will say, for instance, that I believe that in these basins on the west side of the river we can materially improve that overflow condition by the construction of storage basins. The river is navigable——

Mr. MARSHALL. If you have a surplus of water, one of your objects would be to keep the flow at normal and carry off this surplus?

Mr. BELL. Beginning now at Red Bluff and coming down to the Rio Vista, where the stream discharges into the arm of San Francisco Bay—that is 200 miles?

Mr. LIPPINCOTT. I believe so.

Mr. BELL. That country is all irrigable, from that point [indicating] clear down below Rio Vista?

Mr. LIPPINCOTT. Yes, sir.

Mr. BELL. Would it not be possible to divert a great portion of

that river from Red Bluff and run it down, and remove this flood condition very materially, and at the same time have irrigable canals along the entire length of the valley?

Mr. LIPPINCOTT. Well, it would be an exceedingly large canal that would carry 10,000 cubic feet per second.

Mr. BELL. It would be a navigable canal, too—it could be a navigable canal, and also a canal for the irrigation of the land?

Mr. LIPPINCOTT. It would be a navigable canal and an irrigating canal, and we have measured the maximum flood flow at that bluff at 180,000 cubic feet; so that it would not be, in my judgment, feasible to construct a canal such as you say.

Mr. COOPER. If I understand you aright, the lower end of the Sacramento Valley is at the sea level?

Mr. LIPPINCOTT. Yes.

Mr. COOPER. And the upper end about 400 or 500 feet above the sea level?

Mr. LIPPINCOTT. Yes, sir.

Mr. COOPER. How far is it from the mouth of the river to the head of this country? How far up the valley does that reach?

Mr. LIPPINCOTT. That reaches pretty well up to the valley; I should say two-thirds of the length of the valley.

Mr. COOPER. Would it be possible—besides the canals, or drains, or ditches, or runways, whatever you may see fit to call them—to catch the overflow and divert it so as to protect the valley from being ruined? Would it be practicable to divert the overflow?

Mr. LIPPINCOTT. The general plan that has been most highly regarded out there considers the building of a complete line of levees on either side of the valley, and trying to maintain the upper flow of the river between those levees.

Mr. COOPER. If diverted, could not the water be stored and used later on, when you might be short of water?

Mr. LIPPINCOTT. We believe that we can materially affect those flood discharges by the construction of storage reservoirs. We do not say that the storage reservoirs will eliminate the necessity for the levees, but we do believe we could take what you might call the "peak" off that flood, to the extent, perhaps, of one-fourth.

Mr. MARSHALL. The fact is that there is more water there than will irrigate and run off?

Mr. LIPPINCOTT. Yes; there is more water there than will run off.

Mr. BELL. It is a remarkable condition. For instance, the southern basin contains a great quantity of overflow water, and when you pass through it on the train going from Knights Ferry running up to Marysville, as far as the eye can see there is a great ocean—the one basin merging into the other basin and stretching out as far as you can see.

Mr. LIPPINCOTT. We used to have a site at Sacramento about 60 miles from the mouth of the river, but the river has shoaled so that now——

Mr. COOPER. Does this overflow leave the land swampy?

Mr. LIPPINCOTT. Oh, yes; there are 600,000 acres of tule land there. That is the finest kind of land. I want to correct my figures where I said 210 miles. It is 260 miles. It is about 60 miles from Sacramento to the mouth of that river.

Now, I would like to say that the agricultural opportunities of this section are remarkable. It is somewhat surprising to many to know that in the northern portion of Sacramento Valley it is possible to produce all the fruits and crops that are grown within the State of California. The orange, the lime, the lemon, the raisin grape, and the palm all grow through the Sacramento Valley, best at the higher elevation and on the marginal land of the valley, but practically throughout all that region.

(At this point the chairman, Hon Frank W. Mondell, entered the room and took the chair, vacated by Mr. Tirrell.)

Mr. LIPPINCOTT (continuing). And we contend it is possible by irrigation and by other development to produce a condition of horticulture and of agricultural development there that is not exceeded anywhere in the United States, and at the same time have a great navigable river running through the center of it, with a harbor at the lower end of the valley; and with adequate transportation we believe the opportunities there are very unusual indeed.

Mr. BELL. I want to state to the committee, here is Butte County [indicating on the map], pretty well north in California. That county puts fine oranges on the market six weeks ahead of Riverside, in southern California, and the orange industry is a very great industry there in Butte County.

Mr. COOPER. Is it probable, Mr. Lippincott, with the complete irrigation of this water there, that the cold water from the mountains would have any appreciable effect on the temperature?

Mr. LIPPINCOTT. I should not think so.

Mr. VAN DUZER. It would be a good thing for the Sacramento Valley if it did. It is hot enough to roast an egg there in the summer. [Laughter.]

Mr. LIPPINCOTT. The lands in the Sacramento Valley are all in private ownership, but the water rights, so far, are not seriously complicated. In addition, the lands are held there largely in large holdings, and have been confined continuously since the early settlement to wheat raising. The lands are now showing signs of exhaustion from the continuous cropping of that area in wheat, and the people are reaching the stage now where they are anxious to take up the irrigation idea. Formerly it was regarded as an admission of inferiority to say that irrigation would benefit the country, because they considered they had enough rainfall to raise their crops without irrigation. But they are now reaching a point where those ideas are no longer held.

In this connection I would like to say that there is a remarkable similarity between that central valley of California and the great valley of the Po, in northern Italy. The climatic conditions are much the same, except that the Sacramento Valley has a warmer winter climate than that of the Po region. In Lombardy, however, where they have been irrigating for a thousand years and more, and where water rights have increased in value and irrigation is an accepted fact, you might say the valley of the Po is the classic home of irrigation in Europe. In that Italian section the rainfall is over 40 inches and well distributed throughout the year, while in your Sacramento Valley the rainfall is only about 15 inches; so that you can see we have something to learn as to the benefits of irrigation even in climates moister by far than is the Sacramento Valley.

Mr. COOPER. I am obliged to go to the Supreme Court for a few moments. If this hearing is likely to continue I will come back.

The CHAIRMAN. I do not know what the desire of the members is in regard to continuing after 12 o'clock.

Mr. VAN DUZER. Is not a vote to be taken this morning?

The CHAIRMAN. They will take up the military bill.

Mr. LIPPINCOTT. Well, gentlemen, I have finished, anyway.

The CHAIRMAN. Mr. Newell, has anybody taken up the Pathfinder?

Mr. NEWELL. Yes; Mr. Davis has discussed that. Mr. Savage is here also.

Mr. TIRRELL. I understand Mr. Lippincott has certain data prepared. If it is interesting that can be added to his remarks, can it not?

Mr. LIPPINCOTT. These [indicating] are pamphlets.

Mr. VAN DUZER. In view of the action of the Secretary in reference to the Walker River project, I suggest that they might make a preliminary statement in regard to that.

Mr. BELL. Mr. Chairman, I introduced a bill which I would like to have read, and, if it is thought well, to have it set down for such hearing as may be determined upon.

The CHAIRMAN. Has the bill been referred to this committee?

Mr. BELL. Yes, sir.

The CHAIRMAN. Let the bill be read.

Mr. ARTHUR J. CARLSON, clerk of the committee (reading):

H. R. 18001. A BILL authorizing and empowering the Secretary of the Interior to include swamp and overflowed lands in reclamation projects.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior be, and he is hereby, authorized and empowered in carrying out the provisions of "An act appropriating the receipts from the sale and disposal of public lands in certain States and Territories to the construction of irrigation works for the reclamation of arid lands," approved June seventeenth, nineteen hundred and two, to include swamp and overflowed lands in any irrigation project, wherever the same may be practicable and advisable; such swamp and overflowed lands, when thus reclaimed, to be subject to such charges as the Secretary of the Interior shall deem just and equitable, the same to be paid in annual installments, not exceeding two, in the same manner as charges upon other lands in the project; and so far as the same may be applicable the provisions of the said act of June seventeenth, nineteen hundred and two, are hereby applied to all swamp and overflowed lands that may be included in any reclamation project, as aforesaid.

Mr. BELL. Briefly, Mr. Chairman and gentlemen, it is not my intention to have the reclamation service branch out and go into the reclamation of swamps and overflowed lands; but very often in these different projects the reclamation of swamp lands is incidental, and in some cases it may often become an integral part of an irrigation project, and will probably do so in the Sacramento Valley. Under certain conditions the reclamation service might be so loaded up with the reclamation of swamp lands that the interests concerned in those lands should be made to pay their proportion, and then the reclamation of those lands might be made a part of the project. I think there would perhaps be a disposition to oppose the extension of the powers of the reclamation service to swamp lands. This does not aim at that.

The CHAIRMAN. This seems to be a very important measure, and I think the committee should have a report upon it.

Mr. MARSHALL. There can be no objection to having the opinion f the Secretary upon it.

Mr. BELL. I will ask the chairman, then, to refer the bill to the ecretary of the Interior for report and opinion.

The CHAIRMAN. The bill will be referred.

STATEMENT OF MR. H. N. SAVAGE, SUPERVISING ENGINEER.

Mr. SAVAGE. Taking up the discussion of the investigation carried n by the reclamation service in the State of Utah, there are three rincipal projects.

The first one, known as Bear Lake and Bear River, is an intertate project, but it has been investigated by our branch of the service n Utah.

That contemplates the conservation of the water supply of Bear River by the storage in Bear Lake, then the return of water to the iver, and then, by diversion from the river at one or more places, he protection of such lands as may be decided upon after examiation as being available and desirable for irrigation.

The point of diversion selected on the river is some 12 miles uptream from Montpelier, in the southeastern corner of Idaho, whereby short dam, about 7 feet high, and a canal 9 miles in length, with capacity of 2,000 second-feet, something over 600,000 acre-feet of ater could be diverted into Bear Lake each year. Then with a ery low dam across the outlet of the lake, increasing the flood flow n the lake by about 3 feet over the present normal elevation, and rawing it down about 2 feet below the present normal, the supply n the river could be utilized and turned back into the stream, nnually giving a sufficient supply for the irrigation of something ver 150,000 acres of land. That would require a channel about 2 miles long from the lake back into the river, connecting with the iver just below Montpelier.

A number of tracts of land have been surveyed, and preliminary nes have been run from the river to each of these tracts, and final stimates have been made, based upon the surveys completed, to etermine the cost of irrigating these tracts.

There is a great difference in the lands in point of their producveness, these northerly lands up in Idaho being of much greater levation than the southern lands that can be reached by this river n Cache Valley.

A consideration of the project from the business standpoint must e had before it is determined which of the lands the supply must e taken to. It will be necessary to determine this by the possiilities of diversion. At best it is very difficult, on account of the anyon beeing long and precipitous, and the land being located omewhat above the elevation of the river opposite. There are a umber of additional investigations to be carried on in the stream n the immediate vicinity, and that work will be conducted during the nsuing season.

Now, in the southern portion there has been a great deal of time levoted to the investigation of the Utah Lake project. That conemplates the diking off of a portion of the lake's area to prevent the vaporation. There is something like 90 acres area in the lake.

There is some difference of opinion as to the point to which the water might be allowed to flow out and the gates opened and no more permitted to go back to the land. For several years the rainfall has been somewhat below the normal there, and it has been necessary to install pumping plants at the outlet of the lake and to lift the water from a few inches to a few feet upward in order to get supplies to the irrigation ditches below. The evaporation is approximately 5 feet, or 60 inches, per year, and the run-off from the drainage basin being somewhat constant, if a portion of the area of the lake could be reduced, and thus reduce the evaporation, it was reasonably expected that a larger advantage and benefit could be derived for the drainage area tributary to the lake.

It was considered advisable to determine, first, the feasibility of the outlet channel from the rim of the lake, and as investigations have been carried on we found that the evaporation and use amounted to considerably more than the measured inflow. The result of that discovery has been that we find that an equivalent of 1¼ feet per year is added to the volume of water in that lake from underground springs, which can reasonably be supposed to extend all over the bottom of the lake. We know they do occur in some portions of the lake. In the extreme northwest corner we found, by sounding, a number of very large springs, some of them having an area of an acre or more and a depth of from 75 to 100 feet, and the water coming in at the bottom being warm. At the present time, as the project is thus far developed, it is proposed to make a channel from one of these springs out to the rim of the lake and out to the Jordan River, a distance of about 5 miles from the rim and about 10 miles down to the channel, where it would have to be dredged. The possibilities of this project have not yet been determined. It is a great undertaking. But the value of the water to be obtained is, within reason, such as to justify the incurrence of a much greater expense than most of the other projects under consideration.

While investigating that matter, by request of the people a further investigation was made, to determine the possibility of taking water from the headwaters of the Duchesne River, one of the tributaries of the Colorado River, and bringing it back by natural drainage of the country and storing it in Strawberry Valley, and then taking it by tunnel through drainage to Utah Lake. Investigations show that the project is unwarranted as to quantity of water, but we bring out the feasibility of the project in connection with Strawberry Valley, where about 50,000 or 75,000 acre-feet only can be reasonably expected. That would require a tunnel about 20,000 feet long, but through a soft sandstone, and the grades are such that it could be made with the most economical construction. The people down at Spanish Fork now receive a portion of their water supply from the flood runnels, and have been expressing great enthusiasm over this development.

The CHAIRMAN. That would be quite expensive?

Mr. SAVAGE. That would cost about $20 per acre-foot delivered to the land. That is as far as our preliminary investigations have gone.

The water takers, I am informed by our engineer, are signing up an application to the Reclamation Service for the water at $25 an acre-foot. The land in that section is practically all in private hold-

ings, and an investigation by an engineer will be made after the people have expressed their inclination to pay the full value that it may cost.

The CHAIRMAN. Is it a country of high-priced products?

Mr. SAVAGE. It is. I understand that the land in this immediate vicinity will sell for $100 an acre when it has an adequate supply of water, and the people feel that they could go to very big expense profitably in acquiring sufficient water for a full irrigation.

The CHAIRMAN. Do I understand you, in regard to the Utah Lake project, to say that your investigations have all been with a view simply of reducing the area of the lake and thereby conserving a large amount of water that now evaporates?

Mr. SAVAGE. That was the basis of the first investigation.

The CHAIRMAN. And that in addition to that you propose a tunnel which will lower the present permanent surface of the lake? Is that it?

Mr. SAVAGE. Yes, sir; it accomplishes the same thing. It is a channel or tunnel. It accomplishes the same idea that you have in mind.

The CHAIRMAN. So that on the one hand you propose to receive a large amount of water by reducing the evaporation of the lake area, and on the other hand you propose to be able to use more water impounded than is now used?

Mr. SAVAGE. Yes, by deepening the lake we can draw down the supply. As I say, we have not yet decided that that is feasible to do yet. There are a great many big problems connected with it. It would take some years' time for the people to get their water rights adjudicated before we can determine what is the reliable supply to be secured. There are also investigations to be made in the Weber River for the purpose of irrigating lands south of Ogden and to divert the headwaters of the Weber River into the Provo River. We find in the Provo River a run-off, not used, of something over 7,000 acre-feet, and there are about 10,000 or 15,000 acres being irrigated from the unregulated flow in the vicinity of Ogden, and they have two storage reservoirs of small capacity, one of them of 12,000 acre-feet and the other of 13,000 acre-feet, the one completed and the other under construction.

We find in the vicinity of Croydon a storage-reservoir site where, with a dam 200 feet high, a reservoir could be created with a capacity of 387,000 acre-feet. That would supply water to these lands now irrigated; it would also enable us to irrigate something over 100,000 acres of additional land in that vicinity, and would permit the taking of the low flow in summer, with what high flood could be taken in a canal about 7 miles long across the country from the vicinity of Kamas, from the headwaters of the Weber to the headwaters of the Provo.

That has been carried, so far, only to the extent of a very preliminary reconnoissance. The Union Pacific Railway runs from the canyon and reservoir site, and negotiations have been taken up with the railroad to determine their attitude toward the subject, which must be ascertained before we can determine whether it is financially feasible to proceed further. That diversion from the headwaters of the Weber to the headwaters of the Provo is not, in my judgment, a good

idea. It has been considered many times before, and further examinations should follow as to a good many particulars.

That briefly covers the situation of the three principal projects in the State of Utah.

Mr. MARSHALL. How much time do you need, Mr. Savage?

Mr. SAVAGE. Just what time the pleasure of you gentlemen would like me to take.

The CHAIRMAN. We would like to hear Mr. Savage, of course.

Mr. SAVAGE. I will do so, if you wish it.

PROJECTS IN THE STATE OF WASHINGTON.

In the State of Washington investigations have been carried on upon three principal projects. The first one taken up is the Okanogan. This is the Snake River [indicating on the map], and this is the Columbia River [indicating] and this the Okanogan [indicating]. This is a very small project, and affects about 11,000 acres of irrigable land, situated at an elevation of between 800 and 1,300 feet above the sea level. Practically all the land was unpatented at the time of the withdrawal, and the majority of it has been homesteaded in accordance with the act. There has been reclamation going on, and the returns have been so satisfactory that there has been a big demand for the work of the Government in that locality.

The engineering features of the scheme are numerous and rather difficult, considering the magnitude of the project. It first contemplates the diversion of the waters to the Conconully River, which is one of the tributaries of the Okanogan, to a small lake, and then that is to be turned loose when required and taken down the stream for a distance; and there is also a small basin, which would would require a dam on the main stream of the river, from which water might be conducted down, in addition to the water from the lake, in the same tunnel, the water from the diversion dam running through a tunnel 7,000 feet long, and taking it over to another lake, from which it would be again diverted onto the land.

I mention these things particularly, because the expense of the project and the number of problems of storage and diversion have been such as to lead us to believe that it was not feasible at this time to undertake it. The land is rather rocky in the character of the soil.

Mr. VAN DUZER. How much an acre would it cost to put that under irrigation?

Mr. SAVAGE. As far as our investigations go, we think at least $45 an acre; and because of the number of structures and the uncertainty of foundation under one or two of them there are many points that we would have to take into consideration. They constitute a multitude of small factors which in the aggregate make quite a large one.

The main project investigated for construction is the Palouse. That will irrigate about 100,000 acres of land, situated at the junction of the Snake and the Columbian rivers. It is 600 feet at the highest elevation of the main distributing station. The water supply would be taken from the Palouse River from the dam and then discharged through a cut in the upper rim in the coulee, which of itself is an inclosed basin.

The coulee is 30 miles long, and it is proposed to utilize the western half of it as a resrvoir, where, by a dam 40 feet in height at the present outlet, we could have a storage of about 80,000 acre-feet.

Mr. LIPPINCOTT. I did not know what a coulee was until I went up there. Possibly these other gentlemen do not know what it is.

Mr. SAVAGE. The coulee is a provincial expression used up there. It is the name applied to practically a deeply headed canyon. It may be a canal through a ridge, discharging either way, convex or concave; and it is supposed to be of glacial construction. This country up here [indicating on the map] is a country of coulees. Lake Chelan is a coulee of several miles in length. These coulees may be in the form of a lake, and may be convex and still have mountains rising beside them. This little lake is 5 miles long and not over a quarter of a mile wide, and its water is perhaps 15, 20, or 30 feet deep. The canyon's walls rise nearly a thousand feet perpendicularly, and when you go up to the head of the lake and continue on through the canyon you find there is another lake discharging the other way. Here is another coulee [indicating on the map] known as the Grand Coulee, running southwesterly from the Columbia River below the Colville Indian Reservation.

From its appearance it was evidently the former channel of the Columbia River, and it is several hundred miles long, and a mile or more wide, and 70 feet deep. It has a storage reservoir site where a dam 100 feet high would impound something more than a million acre-feet of water. This coulee spoken of here [indicating on map], called the Washtucna, is one of the active type, and has water in its lowest portion at the present time. The run-off is very little, so that it is practically all evaporated. But it is proposed to use that coulee, and by building a dam a little higher at the upper end and increasing the storage from the foot of the coulee, water would be taken down to the end of the canyon.

The CHAIRMAN. How much land would that supply?

Mr. SAVAGE. About 100,000 acres.

The CHAIRMAN. Have you decided as to the feasibility of that project?

Mr. SAVAGE. We have as to the physical feasibility, and have now under negotiation some of the rights of way. Some of the rights of way have been rehabilitated in the coulee since we began to make the investigation. This will have to be gotten out of the way before we determine the financial feasibility of the project. One-third of the land is in private holdings, and a little over a third is railroad-grant land, and the balance is public domain.

The CHAIRMAN. Now, Mr. Savage, will you be kind enough to extend in the record your remarks so as to cover the other projects you have taken up in Washington, to be used in connection with the statement you have already made?

Mr. SAVAGE. It will give me pleasure to do so, sir.

The CHAIRMAN. We shall be glad if you will.

Mr. MARSHALL. And he might elaborate those he has already referred to.

Mr. SAVAGE. I will be glad to do that to any extent you wish.

Thereupon, at 12 o'clock m., the committee adjourned.

FEBRUARY 11, 1905.

The committee met this day at 11 o'clock a. m., Hon. FRANK W. MONDELL, chairman, presiding.

The CHAIRMAN. Gentlemen, I think there are a sufficient number of members present to warrant our beginning the hearing. After consultation with several members of the committee, I thought it would be well for us to hear from the gentlemen in the Agricultural Department who have to do with the subject of irrigation, so that if we print these hearings we may have their statements in the printed hearngs along with the others heretofore taken.

The Agricultural Department has been doing a very great work, a splendid work, in connection with irrigation. Its work has been in relation to the use of water on lands, with a view to aiding the farmers or irrigators in the attempt to bring about improved methods in the use of water in irrigation. It is a very comprehensive work and a very important work; a work which has been carried on with a great deal of vigor, industry, and intelligence.

We would like to hear from Doctor True as to what his department has been doing along this line.

STATEMENT OF DR. A. C. TRUE, DIRECTOR OFFICE OF EXPERIMENT STATIONS, DEPARTMENT OF AGRICULTURE.

Mr. TRUE. Mr. Chairman and gentlemen of the committee, through the liberality of Congress the irrigation and drainage investigations of the Department of Agriculutre have developed very rapidly during the past two or three years. A large amount of data has been collected, a good deal of which has not been published, and the scope of the investigation has been enlarged. For that reason Secretary Wilson, as well as Doctor Mead and myself, was very glad to receive an invitation to explain our work to this committee, which is charged especially with the work of promoting this work of irrigation.

In order to economize time I have drawn up a brief written statement which I propose to read. But, of course, I shall be glad at any point to have members of the committee ask questions.

Mr. REEDER. I want to ask a question as to the amount of territory covered, and want to know particularly as to how far east these experiments have been looked into—that is, as to the use of water?

Mr. TRUE. We will try to explain that matter quite fully as we go on.

Mr. REEDER. I have been surprised to see the amount of irrigation that is being done in Florida and in Louisiana—States which we supposed were almost humid. But if you include that in your remarks, never mind.

Mr. TRUE. It has been my duty to have supervision of this work, and I shall, therefore, deal with the more general matters relating to it, leaving to Doctor Mead to explain the details more fully.

The irrigation and drainage investigations of the Department of Agriculture are the logical outcome of a general movement in this country for the development of a comprehensive system of agricultural education and research. This movement has made very rapid progress since the establishment of the agricultural experiment stations in all the States and Territories under the act of March 2, 1887

(Hatch Act). These stations have carried their investigations into every branch of agriculture and the data which they have accumulated have made it possible to formulate a true science of agriculture (as distinguished from the fundamental sciences on which it is based) and thus to establish the courses of instruction in our colleges of agriculture on a sound pedagogical basis, and to disseminate among our farmers a large amount of accurate information by which they have been enabled to improve the practice of their art.

The main branches of the science of agriculture are plant production, animal production, agricultural technology, rural engineering, and rural economics. The attempt to formulate this science and to base the instruction in the agricultural colleges upon it has led to specialization of the work of instructors, with the consequent enlargement of the agricultural faculties and a great increase in the number of students. It has also greatly stimulated research along agricultural lines by showing what are deficiencies in our knowledge of agricultural problems and thus presenting numerous definite tasks for agricultural investigators. This has led to the enlargement of the work of the experiment stations and especially of the Department of Agriculture.

When Secretary Wilson took charge of the Department in 1897 he found that its operations covered only a fraction of the field of agricultural science and that its organization was very incomplete. He therefore undertook the reorganization of the Department and the expansion of its work in many directions. This led to the organization of bureaus chiefly along the lines of the division of the science of agriculture, and we now have the Weather Bureau, Bureau of Soils, Bureau of Plant Industry, Bureau of Animal Industry, Bureau of Entomology, Bureau of Chemistry (really a Bureau of Agricultural Technology), and Bureau of Statistics (dealing with subjects in the range of rural economics).

The great subject of rural engineering, which in 1897 was represented in the Department by the small office of road inquiry, has been gradually given increased attention, first by the establishment of irrigation investigations, then by the addition of drainage investigations, and lastly by the beginning of investigations relating to farm structures and machinery, and the use of different kinds of power for agricultural purposes. Aside from the road work, the rural engineering investigations are at present organized as a division of the Office of Experiment Stations, but it is hoped that ere long they will be given a separate organization as a bureau of rural engineering.

These investigations were begun through the efforts of western Congressmen and Senators in response to a demand for a broad, scientific, and impartial study of certain fundamental questions having a vital relation to the success of irrigated agriculture, which had thus far been neglected by the General Government and which could not be dealt with adequately by State authorities for lack of means.

Among those were the legal and social questions created by the diversion and use of rivers in irrigation, and which made necessary a radical change in the laws and policies which had hitherto controlled the water of streams in the humid sections of the country. The growing litigation and controversy over water titles showed the need of a better understanding of the legal and economic principles

which should govern the relation of irrigators to one another. In the rapid diversion and use of streams in irrigation by private enterprise, the fact that irrigation is an organized industry had in a measure been lost sight of, and actual development had outrun the creation of administrative regulations and social and economic institutions needed to give stability to titles to water and prevent controversy and litigation, which was retarding development and agricultural prosperity in many sections of the West. Both State authorities and the representatives of the General Government realized that, with the growing use and increasing value of water, it was necessary to begin to gather the facts needed to bring about an intelligent solution of these questions. As these matters involve agriculture, engineering, and economics, they can only be studied by men of special capacity and experience.

The gathering of facts must include the whole country, and the work must be carried on under the direction of men having an acquaintance with the conditions and needs of the whole country. Even if the States had had the means to make these investigations, it was impossible for any State working alone to determine a policy which would have general application. The General Government's direct interest in this question was because of its ownership of large bodies of land which are being irrigated by private enterprise, and the fact that the General Government must sooner or later deal directly with interstate water-right controversies made it necessary that the facts should be gathered by agents freed from any local or sectional influence and interpreted with respect to the needs of the country as a whole.

The work was made a part of the Office of Experiment Stations because this made possible a simple and direct cooperation with a large body of experts who were dealing with these problems on the ground, and who were in a position to reach directly the irrigators most concerned, and to bring directly home to farmers the work done by the Department. Two State agencies for the promotion of irrigation development stood in especial need of this aid. These were the State engineers' offices and the State experiment stations. The State engineers in the administration of the water law, and the State experiment stations in the solution of the agricultural problems of irrigation, were compelled to deal with questions about which there was little accurate or definite information, and which their means would not permit them to obtain.

They, therefore, welcomed the assistance of the Department of Agriculture because it strengthened their hands and made their work more efficient. So far as the State experiment stations were concerned, it not only made possible an extension of their investigations, but it furnished an agency for unifying methods of experimentation for different stations cooperating in a study of the leading problems, under which duplication is being avoided, unity of method secured, and the educational value of the work of each station improved because of convenience in comparing the results of experiments in widely separated localities. This cooperation of the Department with the stations in studying irrigation and drainage questions is, therefore, directly analogous to the work being done in plant production and other branches of agriculture.

The national legislation for the institution of such researches has therefore naturally recognized the agricultural colleges and experiment stations, and a large part of our work in irrigation has been and is carried on in cooperation with these institutions in the several States and Territories. Since the colleges and experiment stations are in close touch with the practical irrigators and farmers in their several communities, it has thus been easier for the Department to bring its work on irrigation home to the large number of practical men for whose benefit this work is carried on.

In organizing its work in irrigation, the Department has followed the lines on which most of its operations are conducted, and has thus had no difficulty in working out a field clearly differentiated from that of the hydrographic division and reclamation service of the Geological Survey. The hydrographic division has for its field the determination of the water supply of the United States available for irrigation, manufacturing, and other purposes. The reclamation service is charged with the construction and operation of great dams, reservoirs, and canals for the irrigation of restricted areas of the arid region, chiefly included in the public domain.

The Department of Agiculture neither determines water supply nor constructs or operates irrigation works. Its duty and privilege are to study the methods for the distribution of irrigation water to farms and for the application of this water to crops, and, in general, utilization of water in agriculture, whether under private or public auspices, throughout the United States. How to make the most of the limited water supply available for irrigation by using it to the best advantage in the production of crops is the task which chiefly engages the attention of the irrigation experts of the Department of Agriculture.

This involves not only studies of the cost of a water supply and of preparing land for irrigation, the methods of applying water to crops, and how to prevent waste of water by seepage and otherwise, but also investigations of drainage systems required to remove surplus water, the machinery needed to secure water (pumps, windmills) to prepare land, to make and harvest crops, and the most complete utilization of the rainfall on the dry areas contiguous to the irrigated areas, the most advantageous crops to grow, and other strictly agricultural problems. In doing this work, the Office of Experiment Stations cooperates with the Weather Bureau, Bureau of Plant Industry, Bureau of Chemistry, and any other branches of the Department, through which it is possible to so extend investigations as to make them meet to the fullest degree the needs of farmers practicing irrigation in the West or in the East.

The extent of the irrigation work of the Department of Agriculture is shown by the fact that during the past year it included field work in 30 States and Territories and in the Hawaiian Islands and Porto Rico.

Mr. COOPER. How many States did you say?

Mr. TRUE. Thirty States and Territories.

According to Bulletin 16 of the Census Bureau the number of irrigated farms in the United States in 1902 was 134,036, aggregating 9,487,077 acres, which have been supplied with water at an expenditure of $93,320,452.

The CHAIRMAN. What is that amount?

Mr. TRUE. That is, in three years 23,480 farms, aggregating 1,704,889 acres.

The CHAIRMAN. Sixty thousand acres per year?

Mr. MEAD. No; 600,000.

The CHAIRMAN. Excuse me, I mean 600,000.

Mr. TRUE. Yes. Since 1902 agricultural settlement and the extension of irrigation have gone on more rapidly than ever before. This is brought out in the last report of the State engineer of Colorado. In 1903 and 1904 there were begun in Colorado, under private enterprise, 1,093 ditches, having an aggregate capacity of 37,817 cubic feet per second. In the same time filings were made for 392 reservoirs, having a total aggregate capacity of 149,586,227 cubic feet. In 1904 over $3,000,000 was paid to Colorado farmers for sugar beets, and over $700,000 paid to factory labor in converting these beets into sugar. Over $10,000,000 has been invested within the past five years in sugar factories in that State, while the total value of all products grown under irrigation in Colorado in 1904 was $40,000,000.

Mr. REEDER. Does that include the expense of procuring and putting that water upon the land?

Mr. TRUE. I do not understand that it does.

Mr. REEDER. What does that ninety-three millions include?

Mr. TRUE. It includes the construction of the——

Mr. MEAD. The main canals.

Mr. REEDER. I was figuring over what it cost per acre, and I thought it was pretty low.

Mr. TRUE. These figures are far below the full expenditures made in reclaiming.

Mr. REEDER. I see.

Mr. TRUE. Yes; I say these figures are far below the full expenditures made in reclaiming, there being thousands of ditches of which there is no official record, and the Census Bureau's figures only include the cost of canals and do not include the expenditures for removing brush, building laterals, and grading land, all of which must be done before irrigation begins. The cost of these items, according to the statistics gathered by this office, has varied from $5 to $30 an acre, making it certain that the total expenditure in providing for the watering of land irrigated by private capital is over $200,000,000.

The value of the crops produced on the irrigated lands in the arid States in 1902 is estimated at $98,468,011. This does not include the rice fields of the Southern States, the cranberry marshes of Wisconsin and New Jersey, nor the valuable products of the market gardens of the Southern and Eastern States. If these were included it would make the total value considerably more than $100,000,000.

The report of the census in 1902 showed that in three years 23,480 farms, aggregating 1,704,889 acres, had been added to the irrigated area.

The CHAIRMAN. Can you tell us how much it costs now, compared with what it did three years ago, to make sugar out of beets?

Mr. TRUE. I have not the figures in mind.

Mr. TIRRELL. They were claiming when we had the great controversy in the House that they had got it down so as to make beet sugar at 3½ cents a pound. Now, this development of the industry has ir

creased so rapidly that I did not know but that you could give us the cost at the present time.

Mr. TRUE. No, sir; I have not got it myself.

Mr. COOPER. Do I understand from these figures as to Colorado that the total growth of the sugar beet in Colorado is due to irrigation?

Mr. TRUE. It is grown under irrigation.

Mr. COOPER. Could it be grown at all without the aid of irrigation?

Mr. TRUE. I do not understand that it could.

The CHAIRMAN. Would you allow me to state right there that the report of the State engineer of Wyoming is just out? I have a copy of it here, and if you will allow me, I will give it to the stenographer and put it in the hearing.

I will state to the committee that the State engineer reports that the records of his office show that the per cent of failures on the part of applicants is small. He says: "If all the work provided for by the permits issued during the past two years is carried out, 907,915.64 acres of land will be reclaimed, at a total cost of $2,274,023, or $3.05 per acre. This will be accomplished by the construction of 2,242 miles of canals and ditches and the storing of 276,758 acre-feet of water in our reservoirs."

Mr. TRUE. Yes; I will be glad to have that inserted. I have just a brief statement along that line, only a little different.

Mr. TIRRELL. And that is two-thirds of the whole territory of Massachusetts and more.

Mr. REEDER. Is it?

Mr. TIRRELL. Yes.

The CHAIRMAN. Those are the applications of two years.

Mr. REEDER. Oh, yes; I see.

Mr. TRUE. Now, during the last two years applications for more than 500 new ditches and canals were made to the State engineer of Wyoming.

In Idaho, between March 11, 1903, and November 1, 1904, 1,285 applications for permits to use water were received and 900 permits were issued. The combined capacity of these canals is 27,951 cubic feet per second of water for irrigation and domestic purposes and 76,000 cubic feet per second of water for mining and power purposes. The land described under the irrigation canals aggregates 1,672,132 acres. In other words, the permits issued for private works in Idaho during a year and a half exceed the entire aggregate of the acreage to be reclaimed under the Government reclamation works thus far approved.

The CHAIRMAN. Exceed what, did you say?

Mr. TRUE. They exceed the aggregate of the acreage to be reclaimed by the Reclamation Service under the projects already approved. As I understand, they expect to reclaim a little over a million acres—a hundred thousand acres over a million.

A wave of immigration is peopling the broad stretch of semiarid country east of the Rocky Mountains between the Gulf of Mexico and Canada. Many of these settlers wish to irrigate part of their land, a large percentage must do so, and this is bringing about an era of irrigation development by means of pumping from wells and of gravity irrigation from small storage reservoirs.

Nearly all of these immigrants are from the East and know

nothing whatever of irrigation methods. The Office of Experiment Stations is making a special effort to lessen their perplexities and meet their needs by preparing popular bulletins showing how to prepare land for irrigation, how to install and operate pumps, how to build and protect small reservoirs, and how to make the best use of the water supply. Through the series of Farmers' Bulletins which are issued in very large editions and distributed mainly by members of Congress, the Department is enabled to make this information readily available to a very large number of people.

Mr. REEDER. Are these bulletins listed in the regular list of bulletins?

Mr. TRUE. Yes, sir. During the past five years irrigated agriculture has made a remarkable advance along the Gulf coast.

The CHAIRMAN. While you are talking of bulletins, Doctor, let me interrupt you just a moment to say to the committee that some of these publications which the gentlemen, in their modesty, call "bulletins" are, as a matter of fact, exceedingly valuable contributions to the science of irrigation, and I hope the gentlemen will take the time to go over them. One publication, for instance, The Use of Water in Irrigation, is a classic on the subject of the use of water in the irrigation of lands, and in my opinion it is the most exhaustive and thorough work of that kind ever published in the world.

Mr. REEDER. Are they all bound in this form?

The CHAIRMAN. Have you any further copies of that bulletin, Doctor True—The Use of Water in Irrigation?

Mr. MEAD. We have them.

The CHAIRMAN. That is bound in cloth?

Mr. MEAD. Yes.

Mr. TIRRELL. What is the number?

Mr. MEAD. I will tell you what I will do. I will send the members of the committee a complete set each.

The CHAIRMAN. This work is very valuable in giving information relative to the volume of water required in a given locality, as indicated by actual practice in the application of water. The Department went into this very thoroughly. How many different measurements did you make? How many are indicated in that work?

Mr. TRUE. A large number.

Mr. MEAD. Over a thousand.

Mr. MARSHALL. These are not all Farmers' Bulletins. They are of two classes.

Mr. MEAD. The best of them are not Farmers' Bulletins. They are published under the head of the Department publications that are intended for distribution by the Office of Experiment Stations.

Mr. REEDER. I wish you would include a list of those publications. My people are interested in this subject.

Mr. COOPER. The people in my district do not know what irrigation is.

Mr. MARSHALL. There are two classes of these bulletins, and the most valuable class are the ones that are not printed in such large numbers as Farmers' Bulletins. You can get an unlimited number of the Farmers' Bulletins, but your number of these most valuable ones is limited.

r. COOPER. I do not think I have been able to get hold of them. nt out over 18,000 Farmers' Bulletins last year. I make it a t to get all the late bulletins that come out, and I start out with ate publications—all those that I think will be of interest to the le in my district, and I send out large quantities every year. Of se, irrigation is not a subject in which our people are interested.
r. TIRRELL. I have made up my mind that we do not know any- g about politics in the East. [Laughter.]
r. TRUE. I was simply referring to the bulletins which have been ared especially for the newcomers in the field of irrigation. The er bulletins are more elaborate——
r. MARSHALL. And more technical?
r. MEAD. No, sir; they are not more technical. No, sir.
r. MARSHALL. I have read several myself.
r. MEAD. Here is the point: A Farmers' Bulletin is practically ted to twenty or thirty pages. There are a great many things ected with irrigation practice that you can not get into that num- of pages. It is largely a matter of pages.
r. COOPER. You put in as many as eighty or one hundred pages, tice, in some of the Farmers' Bulletins.
r. TRUE. They try to hold us down as much as they can.
r. MARSHALL. You could take these larger ones and run them a number of bulletins?
r. COOPER. That one on your good-roads proposition—I sent several thousand copies of it, and it made for me a great deal of ble. Everybody wanted me to be for that Brownlow proposition onsequence of reading that bulletin.
r. TRUE. Now, taking up a little different field of work; during past five years irrigated agriculture has made a remarkable ad- e along the Gulf coast. Tobacco and truck farms are being irri- d in Florida; sugar and rice in Louisiana and Texas. Nearly he water utilized in this region has to be pumped, and more than 00,000 has been expended in pumping machinery within this od.
r. COOPER. By whom?
r. TRUE. By the farmers.
r. COOPER. Not at public expense?
r. TRUE. No, sir; it is all private work.
ow, the high cost of machinery and of the water lifted makes a vledge of how to distribute and use it to the best advantage of cial importance. It has also created a number of important legal economic questions connected with the adjustments of rights to r from streams. The practical value of the reports on rice irri- on and pumping has been recognized by both irrigators and the mercial and business interests of that section, and the extension of investigations has been urged by associations of rice growers, New Orleans Board of Trade, and many other important bodies. hus far the National Government has not irrigated any land, pt a few acres on Indian reservations, but the Reclamation Serv- has recently announced that it hopes within a few years to have t 1,000,000 acres under reservoirs constructed with the reclama- fund. The information which the Department of Agriculture llecting and distributing will, of course, be available to the officers he Reclamation Service and to all farmers who take up land re-

claimed by the National Government. It is, however, evident that, at least for many years, the chief business of the Department as related to irrigation will be to obtain and supply information to the people who are irrigating land at their own expense and entirely under private auspices.

Outside of the Government work, as we have seen, is a very large field, and that will be the field which we must occupy, at least for a long time.

The direct management of the irrigation and drainage investigations of the Office of Experiment Stations has from the outset been committed to Dr. Elwood Mead, whose training and experience have peculiarly fitted him for this work, and I am very glad that he is now to have an opportunity to explain to this committee what is being done under his direction for the advancement of the interests of the irrigating farmers of this country.

The CHAIRMAN. Now, Doctor True, we are very much obliged to you for that statement. Unfortunately we now have only fifteen minutes left until the time for adjournment arrives. That is a very short time in which to hear from Mr. Mead, but that is all we can give him, unless we could have an adjourned meeting. However, the committee will be very glad to hear from Mr. Mead.

Mr. TRUE. I have not gone much into details.

The CHAIRMAN. I know that. We shall be glad to hear from Mr. Mead.

I want to say for Mr. Mead that there can be no question but that he brings to this work a higher knowledge of irrigation laws and practices, both in the United States and in the world at large, than is possessed by any other American, so far as I know, and I have had occasion to go into that matter very thoroughly. He has given that subject a great deal of attention for many years, going into the question of irrigation laws and irrigation practice and irrigation methods and all those things that relate to the use of water in irrigation, not only as to the laws and customs and practices under which the water rights are acquired and the water distributed, but also as to the practices under which the water is used.

Now, Mr. Mead, we shall be very glad to hear from you.

STATEMENT OF MR. ELWOOD MEAD, CHIEF OF IRRIGATION INVESTIGATIONS, DEPARTMENT OF AGRICULTURE.

Mr. MEAD. I have brought with me some of the results of our work in 1904, but it will be impossible to cover the field of this work in the time that is allowed, and, therefore, before I begin, I would like to know whether you prefer that I select some of the leading features with the idea that this is to be our last hearing. If there is to be an adjourned meeting, I will deal with it in a different way.

Mr. MARSHALL. Why could we not have another meeting to-day? I understand they will take up the naval bill in the House to-day.

The CHAIRMAN. Take up the naval bill to-day?

Mr. MARSHALL. Yes; I am told so.

Mr. REEDER. You can call up the Speaker's room by telephone and learn.

The CHAIRMAN. We have very little time now. I am very anxious have the members of the committee here when we do hear Doctor ead, because, gentlemen, he thoroughly understands this feature.

Mr. MEAD. I would be very glad to go over the subject, so as to give ou some idea of the conditions that prevail in irrigation as it is being eveloped to-day.

The CHAIRMAN. If we could have a meeting this afternoon for bout an hour it would give Mr. Mead an opportunity to go very thoroughly into the subject, and I further want to talk with the members s soon as I can in regard to this matter of a trip. We have not even ime to do that now.

Mr. MEAD. Let me take up one feature of irrigation practice that vill consume about as much time as you now have.

Our work in irrigation practice divides into two lines: The development of the best methods for the people who are already irrigating, and the diffusion of information concerning that subject mong beginners.

People have had to take up this matter of irrigation and learn by xperience. Beginners have largely copied what they found in the istricts where they settled. If the practice was bad they have opied it. Each valley is isolated in a measure, and the people who o into a particular locality may not realize whether it is a good or a ad practice that they are following.

Now, part of our work is the diffusion of information regarding hat is good practice.

The CHAIRMAN. Now, Mr. Mead, if you will excuse me just a oment, because I have to leave, Monday is our regular meeting day, nd I can not imagine anything more important to the members of e committee than to hear Mr. Mead at length upon this matter, at ast for three-quarters of an hour or an hour. If we can have that me on Monday, he can finish his brief statement now and conclude on Monday, provided it is possible for the members of the committee to be here on Monday.

Mr. TIRRELL. If we could have a meeting at 11 o'clock on Monday would give ample time.

The CHAIRMAN. Yes; and I want to go pretty thoroughly into the tails about that trip this time.

(At this point the chairman of the committee retired from the om and Mr. Tirrell assumed the chair.)

Mr. MEAD. Then I will be with you on Monday.

I will take up to-day the methods we follow in reaching these ginners. We have in our regular force of field agents about forty-e people, and, as Doctor True pointed out, we are cooperating with arly every agricultural experiment station in the arid region. here is at each of those stations some one who is giving especial tention to irrigation. We have arranged so that these men ganized into a working body. Every season we take up some fea re of irrigation practice about which there is need of a better underanding, and during that season, in connection with our other work, it not to the exclusion of other things, we take up the collection of formation regarding that feature of irrigation practice.

Last year we took up the cost of preparing land for irrigation and e methods of applying water to the land. In collecting this infor-

mation we had our field agents in every arid State observe the methods where land was being made ready for irrigation. These studies were supplemented by interviews with people who had done the largest amount of work, to get the actual cost and descriptions of the tools employed and the method adopted for the application of water. Those reports, in the aggregate, represented the results of hundreds of actual improvements in the preparation of hundreds of farms for irrigation, and the cost of that work ranges from $2.50 to $35 an acre for the grading.

In the selection of the methods it was entirely a matter of accident whether the man had hit on the plan best suited to his locality, because the irrigated territory is not continuous. It is a series of oases in the surrounding solitude, and settlers in each of these oases usually follow the plan of the first irrigator.

In one valley, where 275,000 acres of land are being brought under irrigation, farmers were following one method of preparing land to the exclusion of all others. It is a valley where the growing of beets promised to be profitable. It is a valley where diversified farming is necessary in order to maintain the fertility of the land. Yet the method adopted is only suited to one crop and will not permit of beet growing at all. It happens that this crop is now the most profitable one that they can grow. However, it will cease in time to be the most profitable, and when diversified farming is adopted they will have to change their whole system of irrigating. Our bulletin describing different methods of preparing land and applying water met the paramount need of these settlers, as it does that of thousands of other beginners.

We have distributed 8,000 copies of that bulletin in California alone.

I have given you one illustration of the methods by which our work is being carried on in collecting the results of practical experience. Last year we took up the methods of water measurement. The farmer who irrigates finds his bill for water one of his heaviest expenses. There was paid last year altogether about $20,000,000 for water, and hence the method of measurement is a matter of very great importance, in order that men may get what they pay for, and that they will understand and feel that they are getting what they pay for, to the end that controversy shall be avoided.

Now, the majority of farmers can not take a work on hydraulics, with its complicated formulas, and compute the discharge of their lateral or measuring box, but they can take a report that describes in simple language how water is being measured from existing ditches and explaining the conditions which affect the accuracy of this measurement and apply this information to their own case.

Mr. TIRRELL. I want to inquire why all those bulletins were distributed in California alone. I understood you to say 10,000 copies were printed and 8,000 distributed in California. That would leave the rest of them in the Department here?

Mr. MEAD. In the first place, California paid $5,000 to help obtain that information.

Mr. UNDERWOOD. Doctor, I hate to leave you in the midst of your talk, but I must go to the House. I hope to hear you later on Monday.

r. MEAD. Yes; California paid $5,000 in aiding this work. This the particular information which they needed, and they needed r this reason: People have gone into the State very rapidly, and y man that went in to irrigate must prepare his land as the first toward growing a crop.

r. TIRRELL. Went in where?

r. MEAD. The district I was speaking of in referring to Calii.

r. TIRRELL. Where is that?

r. MEAD. On the Tuolumne River. It is the Modesto and Tur- irrigation district. It is a municipal district, where the money ssary for carrying on the work was raised by selling bonds, and bonds were made a lien on the canal. The same rapid develop- t is going on in another part of California, where a canal system, ch had water turned into it in December, will water over 200,000 s of land. That land has all been cultivated heretofore without gation. It has all been improved with fences, farmhouses, and ns, and people are going in from Nebraska and Iowa and from over the East to begin a new form of agriculture there. It will very easy to injure that land by the injudicious application of er, and it is very easy for these people to make a great mistake adopting the wrong methods and applying the water improperly. l it was that urgent demand which seemed to require the diffusion his information.

r. TIRRELL. Would the committee like to go on now?

r. MARSHALL. I would like to go on the floor myself.

r. REEDER. When we adjourn, let it be until half-past 10 o'clock Monday.

r. MARSHALL. Or, say, 11 o'clock.

r. REEDER. I move we adjourn until half-past 10 o'clock on nday.

r. TIRRELL. Very well; without objection, it is so agreed.

hereupon, at 12.05 o'clock p. m., the committee adjourned until nday morning, February 13, at 10.30 o'clock.

COMMITTEE ON IRRIGATION OF ARID LANDS,
HOUSE OF REPRESENTATIVES,
Washington, D. C., February 13, 1905.

he committee this day met at 11 o'clock a. m., Hon. Frank W. ndell, chairman, presiding.

he CHAIRMAN. Gentlemen, I presume we might as well continue ring Mr. Mead on the matters which he has been discussing.

TEMENT OF MR. ELWOOD MEAD, CHIEF OF IRRIGATION ND DRAINAGE INVESTIGATIONS, DEPARTMENT OF AGRICUL- URE.

r. MEAD. Mr. Chairman and gentlemen of the committee, in order t I may not get too far away from my subject I have written out statement, which, however, I will not attempt to read in its en- ty, but will refer to some figures which I would probably get ong if I quoted them from memory merely.

The act of Congress defining the scope of the irrigation and drainage work of the Department of Agriculture has been changed but little since its beginning eight years ago. The paragraph in the appropriation for 1906 reads as follows:

Irrigation and drainage investigations: To enable the Secretary of Agriculture to investigate and report upon the laws of the States and Territories as affecting irrigation and the rights of appropriators and of riparian proprietors and institutions relating to irrigation and upon the use of irrigation waters at home and abroad, with especial suggestions of the best methods for the utilization of irrigation waters in agriculture, and upon plans for the removal of seepage and surplus waters by drainage, and upon the use of different kinds of power and appliances for irrigation, drainage, and other agricultural purposes.

It will be seen that this includes two lines of investigation. The first relates to water rights, the administration of streams and canals, and the social and economic relations of irrigators to each other. The second deals with the practice of irrigation and includes methods of providing a water supply, distributing it among irrigators, and the improvements in irrigation practice, both in preparing land and applying water.

The drainage work in the irrigated district deals with the restoration to production of lands that have been injured by overirrigation or swamped by seepage water. On the legal and economic side it has to do with the organization of drainage districts, the determination of the principles which should govern the ownership and disposal of seepage water, and the determination of assessments and benefits where the work is carried out under district or municipal control.

As the drainage work in the humid States is somewhat foreign to the duties of this committee, it will not be referred to further than to say that there are about 100,000 acres of land now unproductive which can be reclaimed through dikes and drains and which if reclaimed would have a productive capacity equal to four times that of the State of Illinois. During the past year we have made studies and reports on the drainage of a number of districts which have led to the beginning of agricultural drainage by private enterprise to cost in the aggregate more than $2,000,000.

The vital relation which the irrigation work of the Department of Agriculture bears to the progress of agriculture in more than half of the United States can be illustrated by giving a brief review of the development of irrigation along the South Platte River in Colorado during the last thirty-five years.

This river drains the eastern slope of the Rocky Mountains in northeastern Colorado. Irrigation from the main stream and the seven principal tributaries began at about the same time and extended in the same manner. There were first small ditches, then larger ones, then the small ones were made broader and longer, and so, on the main river and each of its feeders the acreage watered grew from year to year, and at the same time more water was withdrawn for towns and for factories. Less than ten years after the founding of the Greeley colony the increased acreage, coupled with wasteful use of water, had brought a shortage on the main stream and on each of its branches. Crops under the lowest ditches began to be ruined by drought. Farmers who had been giving their whole attention to overcoming physical obstacles woke up to the fact that a water title was as necessary as a land title if there was to be any stability

peace in irrigated agriculture. Without definite titles and some public regulation the man at the head of the stream could take what he pleased, the man below must get along with what was left.

When this question confronted the irrigators along the South Platte they had to deal with it as an urgency problem. Something had to be done to stop warfare between neighbors and save crops. In order to establish private rights to water they had to set aside inherited ideas and prejudices and abrogate the common-law doctrine which had hitherto controlled the water of streams. In setting up a new government they had to determine what was each man's share and how it should be fixed. Should it be measured by the acres of land watered or by the size of the ditch? Should water belong to the individual as personal property, to use or sell or lend to others, or be a right of use only, limited to a definite ditch or specified tracts of land?

To deal with the whole of the main stream and its seven branches seemed too large an undertaking, hence the main stream was divided into three districts and each of the seven branches was made a district, and water rights in each one of these restricted areas were settled without regard to their relation to rights on other parts of the stream; even within the district they were not established wisely, but ignorantly and mistakenly, as was disclosed when a better understanding of the duty of water and the relation which irrigators should bear to each other was reached.

This settlement availed for a half dozen years only. Then it was discovered that if the holders of rights on the head of the main stream and on the seven branches continued to extend the use of water, rights in the middle and lower districts of the main stream had no value, and that to protect these rights the river and its tributaries must be treated as a unit. Legislation to accomplish this was secured, but the irrigators on the main branches had in the meantime built ditches to utilize all the water. Through injunctions against officials and through other delays which an ingenious attorney can devise, the irrigators on one tributary have prevented the enforcement of this law for sixteen years. In the meantime water has become valuable. Rights which at first sold for $5 now bring $35. Water is now too costly to waste or supply without measurement, but when measurement began it was found that the rights first established were a sorry misfit. Because of carelessness and lack of knowledge of how much water was needed for an acre of land, some appropriators had been given ten times as much water as they were entitled to.

The misfits in the adjudications had been carried into the early water contracts of canal companies. Some had agreed to give farmers enough water in a season to cover their land 7 feet deep; others gave about one-fifth this amount. When companies and irrigators began to compare notes all were dissatisfied.

Irrigation has created seepage streams in what were formerly dry channels. Five hundred appropriations of seepage water have been made along the main river. The question arises: Does this seepage water belong to the canal company which created it or to the man who captures it? It is an important question. Canals are being dug to intercept it. This prevents its getting back into the stream, interferes with the doctrine of prior rights, and raises a score of difficult legal and economic questions. There has been lawsuit after law-

suit, but the courts have wobbled so amazingly that irrigators are as far as they were in the beginning from knowing the doctrine which will ultimately prevail.

In the meantime factories have multiplied. They are large users of water. A single factory in Colorado, neglecting to acquire rights by appropriation, has recently paid $225,000 for the rights of an irrigator. Factories which believe they are entitled to water by reason of early use now seek to establish those rights by legal process. They were not included in the original adjudications. Only irrigators and domestic users were represented. Now rights to mines and factories are being established, and a complete readjustment of titles to this water supply is inevitable.

Mr. REEDER. Let me ask this question, as to that water which the factory bought: After they use it, does it go on to the irrigators below, or do they consume it?

Mr. MEAD. It is practically consumed.

Mr. REEDER. How do they manage to consume it?

Mr. MEAD. The company I referred to is the Colorado Fuel and Iron Company, and a great deal of the water they consume goes up in steam.

Mr. COOPER. And I suppose the balance is so contaminated and foul that it is not fit for use in irrigation?

Mr. UNDERWOOD. I reckon they reuse it.

Mr. MEAD. Yes; what is left.

The South Platte is not wholly a Colorado stream. It runs into Nebraska. Originally the entire stream ran into Nebraska. That State adheres to the doctrine of riparian rights. Can the riparian landowners in Nebraska assert that doctrine as against the irrigators of Colorado? If they can, another readjustment is inevitable.

The South Platte is a typical valley. In every State and Territory in the West the same great questions are pressing for solution, and the more intelligent the farmers the more valuable the irrigation work, and the higher the cultivation of the soil the greater is the anxiety for a definite solution of these questions and the more the injury wrought by the ferment that impending change creates. It was this overshadowing need for a knowledge of facts and for the working out of answers to these questions in the early years of development while institutions were forming which created the irrigation work of the Department of Agriculture and made the study of the laws affecting irrigation and the rights of riparian proprietors its first duty.

Mr. BELL. Have they not got the suits to the highest courts?

Mr. MEAD. Yes; but the decisions of the highest courts are not consistent with each other.

Mr. BELL. Have any of the cases been taken to the United States Supreme Court?

Mr. MEAD. No, sir. You see the issues are confused with so many other factors that the decisions do not go to the same point. For example, one suit will be brought by later proprietors, who may claim that this water should go back to the main channel, and another suit will be brought by a ditch company——

Mr. BELL. A large body of proprietors would be affected by this recent law. A question would arise there as to the confiscation of private property and the destruction of private rights, and I should

think they could get that suit before the Supreme Court of the United States.

Mr. COOPER. Take, for example, the laws so far as my State is concerned, governing the right to take water. In damage suits growing out of the destruction of water supplies, in order to establish your rights, you have to clearly trace the channel. You can not guess at it. You must establish the fact that it was your water, and you must trace it definitely.

Mr. BELL. That was not the point I had in mind. Mine was a strictly local question. The State passes a statute now, readjusting the whole situation and attempting to make men give up a certain portion of water which they have been using in order that others may enjoy a portion. That is a fair question, I think, that could be determined absolutely in a court of last resort.

The CHAIRMAN. Is it not true, Mr. Mead, that the tendency of legislation has been toward public control of the waters used in irrigation, and is it not a fact that up to quite recently in some cases the courts have been inclined to make their decisions upon past precedents, and that they have rather leaned the other way?

Mr. MEAD. There is no constitutional question in this case. That has never been contested. It is an illustration of the ingenuity of the legal profession. It always comes up on a new issue every year, so that the points presented and passed upon are not the same, and no classification or harmony can be produced from the different decisions.

Mr. BELL. They shift their grounds, do they?

Mr. MEAD. Yes. It is entirely a question of technicalities.

Mr. REEDER. I would like to ask you, How many rights have been filed on these seepage cases? You stated it a while ago, but I have forgotten.

Mr. MEAD. Five hundred on the main stream. I do not know how many on the tributaries.

Now, as irrigation has been extended and water has become more valuable, the construction of storage works has been found to be profitable. At first those storage works were filled always by surplus water. They were filled at a time when irrigators did not need the water. But the stored water is most valuable at the time when the streams are dry, when the crops are about to be destroyed, when water is measured by the value of the crop; so that stored water, where it is for sale, commands high prices, and storage reservoirs have been the most valuable irrigation property in the State.

Hence the construction of storage reservoirs has gone on until there are more storage reservoirs than can be filled by taking the surplus water, and so purchases have been made of the early rights for direct irrigation for the purpose of filling these reservoirs at a time when the irrigators need water from the stream; and that has begun a new question.

Furthermore, the reservoirs themselves number about 200 on this stream, and the rights or the claims as between themselves to the possession of the water create a new class of priority rights.

Mr. REEDER. Are these 200 reservoirs on the main stream alone?

Mr. MEAD. No, sir. Those 200 are on the main stream and on the tributaries together. A single one of those storage reservoirs has run

into millions of dollars of cost. I do not know whether it is $1,000,000 or $2,000,000, but I know it is a large sum. That reservoir will hold the low-water flow of the main stream for six months.

You can see here how new questions have come up with new developments, how the farmer who went there first had nothing but physical obstacles to overcome, and how his claim to his water rights and to the stability of his water rights has been constantly undergoing change. The latest contention is over the division of water between States, and the lower States are considering the necessity of State action to protect their citizens.

Mr. REEDER. Which State is that?

Mr. MEAD. So far as the South Platte is concerned I refer to the State of Nebraska.

Mr. REEDER. As against what State?

Mr. MEAD. As against Colorado. There we find this further difficulty, that the laws of Nebraska are different from those of Colorado. It is not a case of two sets of rights under the same kind of statutes, but it is two sets of rights based upon a different theory of ownership in two different States. You have not only the question of adjusting prior rights, but the question of adjustment of owners.

Farmers can not ascertain what are the probable or possible evolutions to be created by increasing use, nor how these are to affect the stability and value of their homes, because their horizon is in a large measure bounded by their fields. The people of one locality can not determine how their interests are to be adjusted with those of remote sections. And when we reflect that some of the rivers of the arid region run for thousands of miles through three or four States; that the rights to water include mining, manufacturing, domestic use, irrigation, and navigation, and involve the doctrines of personal ownership, usufructuary rights, and the common-law riparian doctrine, it becomes manifest that only the National Government, working along the broadest lines and looking not simply at a temporary adjustment but toward a system suited to the needs of the remote future, can bring order and system out of this uncertainty.

Mr. BELL. Is the reclamation service going into that branch of it yet?

Mr. MEAD. Only so far as it affects their own projects.

Mr. BELL. This is the Department of Agriculture?

Mr. MEAD. Yes. We are dealing with this from the standpoint of the large number of irrigators who are already using water.

Mr. BELL. From the agricultural standpoint?

Mr. MEAD. Yes.

Mr. REEDER. Is the suit between Colorado and Nebraska of the same character as the suit between Colorado and Kansas?

Mr. MEAD. There is no suit between Nebraska and Colorado, but many of the arid States are awaiting the outcome of the suit between Kansas and Colorado.

The first step toward a rational settlement seems to be a knowledge of facts. First of all, in determining what can be done with a river it must be known how much water is needed for an acre of land. There are now over 150,000 irrigated farms. If water rights are to be based on use, we must know how much is needed, not simply in one locality, but in scores of localities. Lack of this information when rights on the South Platte were established made it possible

for some irrigators to secure water enough to cover their land each season to a depth of 150 feet and others only enough to cover their land to a depth of 3 feet. Extended and continuous measurements of the water used in irrigation are needed to guide the courts in adjudicating water rights, because when an adjudication is made without this knowledge, every one tries to be sure of enough water by claiming all that his ignorance or greed leads him to believe he can ever use. The result is rights which aggregate more than the stream's flow; efforts to hold the excess by improvident use, which injures land and robs others; attempts to derive profits from the sales of surplus water, thus destroying the principle of priority and laying securely the foundation for vaxatious and costly litigation.

Our investigations of the duty of water were begun by measuring the quantity used by irrigators under ordinary practice. Where this practice seemed defective our reports called attention to it and suggested a remedy. Now, we are determining what quantity should be used to give the best results. How wide the variation is between good and bad practice is shown by the following figures:

The first year we measured the water used from the Sunnyside Canal enough was delivered to irrigators to cover the land to a depth of 10 feet. Improvements in practice suggested by reports of this office and put into effect by the canal company reduced the quantity used in 1904 to enough to cover the land to a depth of 6 feet, or a saving of 44 per cent.

There is room for further improvement, as there are numerous evidences of overirrigation. In the Turlock district, in California, enough water was turned into the head of the canal in 1904 to cover the land to a depth of 8.34 feet. Enough was turned on the fields to cover them to a depth of 6.84 feet. In the Modesto district in 1904 enough water was turned into the canal to cover the land to a depth of 13.18 feet, and enough was turned on the land to cover it to a depth of 11.13 feet. This wasteful use of water is filling the soil and will in a few years make drainage necessary unless corrected.

In southern California, where the season is longer and evaporation greater, the water turned into the Gage Canal would cover the land irrigated to a depth of only 2 feet, or about the quantity lost in seepage under the Turlock Canal. The Gage Canal and its principal laterals are cemented. Here is a difference between saving and wasteful use of water sufficient to cover the land to a depth of 11 feet.

Mr. COOPER. Is not the rainfall there greater?

Mr. MEAD. It is three times greater.

Mr. BELL. They have the whole Tuolumne River there, and they simply turn it loose.

When we began our measurements of the duty of water in New Mexico the amount used by the irrigators in one valley varied from 2 to 15 acre-feet for each acre irrigated, and the average of the measurements for three years was between 6 and 7 acre-feet for each acre. Acting on the recommendations of our report, the management of one of the largest canals in this valley has changed his water contracts so as to provide 2 acre-feet of water for each acre of land, but agrees to furnish an additional quantity for an additional charge. During three years no farmer has paid the additional charge, yet the average crops are larger, injury from seepage water has been avoided, and farmers are better satisfied than under the old wasteful method.

When we reflect that irrigators paid last year over $20,000,000 for the water they used, the saving in water charges alone which is being brought about through better methods of application is amounting to an enormous sum, yet this is nothing as compared to the improvement in crops and the prevention of injury to land through excessive use of water.

Mr. UNDERWOOD. There is no section of this country where 15 feet of water is needed to raise a crop, is there?

Mr. MEAD. No; but there were sections of country where from 10 to 15 feet of water was being continuously used.

Mr. COOPER. Did it not ruin the land?

Mr. MEAD. That was the tendency; yes.

Mr. COOPER. What would be the effect of that less use of water? Did it improve the agricultural conditions, or did it injure them?

Mr. MEAD. It improved them very materially. There is, however, a point beyond which economy should not be pushed, as reduced yields more than offset the saving accomplished. The following figures show this:

A field of barley in California, which received the natural rainfall only, produced 9 bushels to the acre; an adjoining field, given 16 inches of water by irrigation in addition to rainfall, produced 22 bushels to the acre. One field, given 4.5 inches of water, produced straw, but no grain; an adjoining field, given 8.5 inches of water, produced 10 bushels to the acre, while a third field, given 24.5 inches of water, yielded 38 bushels to the acre.

In Nevada a field of wheat, receiving water to a depth of 1.85 feet, produced 4 per cent more grain than one receiving 1.45 feet. A field of oats, receiving water to a depth of 2 feet, produced 14 per cent more grain than one irrigated to a depth of 1.68 feet.

Irrigated lands in southern New Mexico and Texas require more water than irrigated lands in Montana and Idaho. In New Mexico tests of the effect on yield of different quantities of water showed that there was a continuous increase in yield with the increase in the quantity of water received, beginning with 36 inches and going up to 65 inches, the tract which received 65 inches producing 39 per cent more hay than the one receiving 3 feet.

Mr. TIRRELL. What is the average amount of water that these lands require, if there is an average?

Mr. MEAD. That is what we are endeavoring to find out. The average under existing practice is about 4 feet measured at the head gate and about 2½ feet measured in the field.

The CHAIRMAN. The difference is lost by percolation.

Mr. BELL. I heard Senator Newlands say in a general statement the other day that if you have enough water in New Mexico now to irrigate 100,000 acres, after you have irrigated 100,000 acres for a few years you will have water to spare for other lands. I construed it that way, at least, but wondered how true that was.

Mr. MEAD. In the beginning of irrigation a large amount of water is absorbed in filling up the subsoil. When irrigation began in Kern County, Cal., one had to go 70 feet to find water. But to-day one can get water within 6 or 7 feet.

Mr. BELL. But that water that you find is water that has gone in there?

Mr. MEAD. Yes, sir. The studies of the duty of water outline a class of investigations directed toward the betterment of conditions in the older settled sections of the West. Let me now take up a line of work which is being carried on for the benefit of beginners. The first thing which confronts the settler on arid land is the material obstacles he must overcome. He must clear his land, lay out his laterals, determine their size and grade, and the method by which water is to be spread over his fields, and must prepare his fields in accordance with the method adopted. If left alone, he will in time find out how to do these things, but it will be a discouraging and costly training and it is wholly a matter of accident as to whether or not the method he adopts is best suited to his conditions. As a factor in arid-land reclamation this has an importance not generally recognized. We have done valuable work to aid the engineer but not enough for the farmer. Every year the number of settlers who begin this apprenticeship runs into the thousands. It is manifest that if they could be given intelligent direction and be placed in a position to avail themselves of the accumulated experience of the past fifty years, there would be a saving in labor, a saving in water, and a lessening of the time required in bringing farms into full production, which add materially to the growth and prosperity of irrigated districts.

To render this assistance, we organized our force, and the agencies cooperating with us in the different arid States and Territories, as explained on Saturday, into an information bureau which is gathering and publishing the experience of irrigators in the different features of irrigation practice. Each year and in each State our agents or associates find out from the best irrigators of that State how they carry on certain features of irrigation practice.

Nor are such collations of the results of practical experience in widely separated sections of the country of value to the beginners only. In many places they are modifying the methods hitherto followed. One fact will illustrate this: Flooding from small laterals is the system of applying water in use in three-fifths of the arid region, but there are districts where this method is entirely unknown and where the publication of this bulletin was the first information these farmers had that such a simple method was feasible.

Among the features of irrigation practice about which our organization has gathered information may be mentioned the construction of current wheels, methods of measuring water, use of cement and concrete to take the place of wood in irrigation structures, and cost of pumping water for irrigation and the factors which affect this.

The studies of irrigation by pumping in 1904 had a wide range. They included statistics of the cost of pumping from over 1,000 different stations. At some of these, field records were kept showing the quantity of water raised, the number of acres irrigated, the amount of fuel used, with its cost, and the value of the crops grown. These field studies were supplemented by laboratory tests to show the efficiency of different makes of pumps. Altogether these studies embraced nearly every kind of power and about every type of pump, varying in size from windmills costing less than $100 and discharging a stream a half inch in diameter to pumping stations costing over $100,000 and discharging a stream 4 feet in diameter. The fuel in-

cluded straw, brush, coal, wood, gasoline, and crude petroleum; the power, steam engines, gas engines, windmills, and electric motors.

These comprehensive studies of pumping were undertaken because the best authorities agree that not over 10 per cent of the arid region can be irrigated from streams. The use of the remaining 90 per cent in agriculture depends in large measure on obtaining water to irrigate from some other source than streams. There is the further fact that improvements in machinery have so lessened the cost of pumping that many farmers are resorting to it where it is possible to obtain water from gravity canals.

During the past season the office has been conducting investigations to determine the possibilities of storm waters and underground waters as supplemental sources of supply. The collection of storm waters requires the construction of reservoirs, while the securing of underground supplies requires pumping. It is believed that by the use of these two methods it will be possible for the owners of the homes on the plains to raise sufficient fruit, vegetables, and forage to provides themselves and their work animals with a food supply which will carry them over years of drought, and thus enable them to maintain their families during those years where heretofore they have been compelled to abandon the land to avoid starvation. It will also add greatly to the comfort and pleasure of ranch life by providing a good supply of fresh vegetables and fruit for household use and render possible the raising of fruit and shade trees, which will make ranches attractive.

Wherever possible, the data given in the reports of the agents of this Office as to the cost of pumping water have been reduced to a form showing the cost of raising 1 acre-foot of water 1 foot. In most instances fuel cost only is given, although in some cases the cost of attendance and incidental expenses are included. The average cost of raising 1 acre-foot of water 1 foot for 53 pumping plants located in California, Colorado, Kansas, Arizona, and Texas is 3 cents. The average lift for these same plants is 45 feet, making the average cost per acre-foot at the surface of the ground $1.35. This includes several kinds of fuel—wood, coal, distillate, crude oil, gasoline, and electric power. These data are brought together in the following table for the purpose of comparison:

Place.	Cost of raising 1 acre-foot of water 1 foot.	Average lift.	Cost of 1 acre-foot of water at ground surface.
		Feet.	
California	$0.066	78.2	$5.16
Arizona	.053	37.1	1.97
Texas:			
Near El Paso	.043	40.0	1.72
Near San Antonio	.026	46.0	1.20

Leaving now the work in which all our agents have cooperated, I will briefly review some of the special investigations carried on in the different States, and will begin with California, where more than 2,000,000 acres of land is now being irrigated, where land and water have a value reached in few, if any, other places in the world, and where practically every irrigation question which has to be dealt

:h in the United States has assumed greater or less importance. In s work we are being aided by the State, which two years ago ap- ›priated $10,000 to be expended under our direction.

[n southern California the long hot summers cause evaporation to a serious source of loss of water. Certain conditions in southern lifornia make it highly desirable that this should be lessened as ıch as possible. The great value of land and water in that section s caused irrigation to be extended until now only the best practices ll make it possible to continue to irrigate the land now under culti- :ion. This condition of affairs prevails in certain parts of the Los ıgeles, San Gabriel, and Santa Ana valleys and some of the dis- cts around San Diego. In some of these valleys the ground water s been lowered 60 to 70 feet by pumping, and in a few instances 200 :t.

For several years the late William Irving, engineer of the Gage nal, conducted experiments for our office to determine the best :thod of distributing and applying water in the Santa Ana Valley. 1905 similar work will be carried on at Pomona in response to the lowing request of the farmers' clubs of Pomona and Claremont, ıere a single pumping plant, now being constructed, is to cost)0,000.

Whereas owing to lack of general knowledge of mechanical principles as ›lied to pumping water, the cost of water for the maintenance of our horti- tural pursuits is becoming excessive: Therefore, be it

Resolved, That the Department of Agriculture be, and hereby is, requested obtain and furnish correct and reliable data as to the present status of water :elopment in Pomona Valley, giving the number, location, size, and depth wells with the quantity of water obtainable therefrom. Also kind, size, ›ed, and efficiency of pump; kind, power, and running cost of motor, together :h such other data as might be of assistance in determining the present tus of our problem.

This data should be from tests of centrifugal and other pumps of various es under all varying conditions as to lift, speed, and water delivered.

Similar demands for the extension of these investigations are ming to us from all parts of the State, the Farmers' Club of Santa ırbara County having recently sent to the Department the following solutions:

Whereas in the fertile and deep soil of Ventura County the value of staple ›ps is increased from two to three fold by the use of water pumped from lls; and

Whereas irrigation investigations are now being carried on by the Office of periment Stations of the United States Department of Agriculture in coop- ıtion with the State of California to determine ways and means of reducing › present cost of pumping water and lessening the enormous losses due to soil ıporation: Therefore, be it

Resolved, That we indorse this branch of investigations as being eminently ıctical and useful and commend it heartily to the liberal support of our ›resentatives in both the State legislature and Congress.

In both these resolutions the importance of pumping has been ıphasized. It is not, however, exaggerated. A knowledge of the nd of pump best suited to a specific use and of how to install and ›erate it affects the profits and success of a large fraction of Cali- rnia's agriculture and horticulture.

Last year our pumping investigations in California included rec- ds of 750 pumps and measurement of the water lifted and the res of land served, with the cost of operation of over 70 pumps. ıe complete report, which will be published shortly, will give to

irrigators a large amount of practical information on the factors which affect the efficiency of pumping plants and the cost of lifting water.

In the Modesto-Turlock irrigation district in the valley of the Tuolomne River we are dealing with different questions. The canals of these two districts will irrigate 275,000 acres of land. The owners of the land know little of irrigation methods and desire advice about preparing their land to receive water and in working out a system of organization by which water will be controlled and delivered with economy and with certainty that each individual farmer will receive his proper share. As these laterals will aggregate hundreds of miles in length and the measuring boxes at the different farms be numbered by the thousand, the working out of such a system is indispensable to the success of the districts.

The assistance of this office was asked in the spring of 1904. The first step was to provide for measuring and recording the water delivered to different users. The districts have adopted the system we organized. It will furnish a practical guide as to the duty of water and tend to check wasteful or injurious use.

The cost of preparing land for irrigation is varying, from $5 to $35 an acre. A study of the adaptability of the various methods of applying water to the conditions of these districts was begun in 1904 and will be continued on a more extensive scale this year. As about 250,000 acres remain to be prepared for water, the expense of doing this will be somewhere between $2,500,000 and $5,000,000. It is exceedingly desirable, therefore, that the plan best adapted to that section be followed.

It may be explained that there are now in the United States about thirty different methods of applying water to field crops, these being modifications of four systems—flooding, furrows, checks, and basins. The check system is a cheap and effective method of irrigating alfalfa. It is not suited to the irrigation of wheat or sugar beets, and hence is not well adapted to a rotation of crops.

It has not been demonstrated whether flooding or furrows is suited to this soil or the slope of the ground. The first step toward rational progress is to test this, and in cooperation with the authorities of the two districts a tract of land has been secured which will be divided into three tracts, one of which will be irrigated by the flooding system, another by furrows, and another by checks. This will help to determine the relative cost of preparation and of spreading water and the influence on yield. The interest in this demonstration is not confined to the Tuolumme Valley. It will affect irrigation practice throughout the great interior valley of northern California.

In no portion of the West are irrigation possibilities greater than in the Sacramento Valley, and nowhere is settlement proceeding at a more rapid rate. The Central Canal, into which water was turned for the first time in December, covers approximately 250,000 acres of land. Across the river from the Central Canal is Butte Canal, which will irrigate a large area. From Cache Creek a canal is being built to irrigate several thousand acres, and there are a number of smaller projects under construction by private enterprise, making a large aggregate acreage.

More than 90 per cent of the irrigable area of this valley is now under cultivation to nonirrigated crops. It is certain that the in-

ase in productive capacity, population, and wealth which irriga-
n will bring about is very great. But progress will depend on the
ɔption of right methods of irrigation and in checking the excessive
l injurious use of water. To promote this, the office in 1904 car-
d on experiments at Chico to determine the quantity of water
ich gives the best results in that section. This year, in cooperation
th the Bureau of Plant Industry, the work will be extended so as to
t the relative merits of flooding, furrows, and checks in applying
ter.

Since the 1st of December we have distributed in California over
00 bulletins describing methods of preparing land for irrigation
d the cost of pumping.

In Nevada our work in 1904 was aided by an appropriation of
,000, made by the State legislature. We studied the duty of water
d the rise of water in the soil.

There must soon be an adjudication of water rights from the Ya-
na River in the State of Washington. When this takes place the
st questions will be: How much water is needed for an acre of land?
ɔw much do farmers use? How much of what is turned in at the
ad gate is lost by seepage and evaporation before it reaches the
rm? The only way to obtain this information is through an actual
easurement of the quantity of water used, and this the irrigation
terests of the valley asked us to undertake. In response thereto,
e water diverted and applied to nearly 300,000 acres of land was
easured in 1904.

Numerous tests of seepage losses were also made. A considerable
rtion of the low lands were threatened with ruin through seepage,
d the drainage branch of our service prepared plans for the relief
a number of tracts of this overwatered land. In every instance
ese plans have proven successful. The source of the surplus water
pply was correctly located and the capacity of the drains were
ıple for its removal. On one hop farm, where the rise of the soil
ıter destroyed the crop in 1903, this investigation located an inter-
pting drain which was dug by the owner, and the land this year
oduced a crop worth nearly $600 an acre.

In Oregon there is about 3,000,000 acres of land under cultivation
a rainfall so scanty that any impoverishment of the soil or any
rious reduction in the average amount of rainfall means the loss of
ops. Here the problem is to devise methods of tillage or methods
conserving the available water supply to meet these possible
anges. Here tests are being made of the value of winter irrigation
d of methods of tillage to check evaporation.

At Bend, Oreg., an irrigation canal has recently been completed
ıich will water about 150,000 acres of land. Neither the managers
this canal nor the farmers who are settling under it know how
ıch water is needed to irrigate an acre of land. They do not know
w the water ought to be applied nor how to organize the farmers
ıder laterals so that each one will get his share of what is turned in
the head-gate. They have agreed that if we will detail an expert
measure the water and determine how much is used and lay out
e work to be done they will prepare a number of fields for testing
igation by checks, by furrows, and by flooding. After a couple of
asons' trial the farmers can proceed intelligently with their im-
ovements. They can not without it.

As irrigation is to have a large extension in Oregon, the early determination of these practical questions means not only a saving of thousands of dollars to farmers, but the ultimate saving of a large amount of water to irrigators and of loss and controversy to canal management, not only under private works, but under the works which the Government will ultimately construct.

In Utah the natural flow of most streams is utilized, so that any further extension of irrigation depends in part on storage, but largely on a better use of the water supply. To bring this about there is need of a scientific study of the water requirements of crops. The work carried on in 1904 in cooperation with the State experiment station included varying the quantity of water applied in irrigation, varying the quantity of water and the time of irrigation to ascertain the effect on the quality and quantity of grain and the cooking qualities of vegetables. Thus far but little success has been had in attempting to grow hard wheat in irrigated districts. The Utah experiments encourage the belief that by skill in the application of water a progressive improvement in this respect can be made. Trials of methods of checking evaporation losses and of the relative merits of flooding, furrows, and checks were also made in Utah.

Utah has over 100,000 acres of land damaged by seepage water. The removal of this water involves problems not met with in the Eastern States, where the surplus water comes from above ground instead of through underground channels fed by losses from canals or overirrigated fields. In many cases, where the source can be located, the cheapest method of relief is by intercepting drains. In Cache Valley, where several thousand acres of land have been rendered unproductive by seepage, we are making experiments to determine the best method of relief. The drainage of the damaged lands of Cache, Salt Lake, Sevier, and Washington counties will bring into production more agricultural land in Utah than anything else involving an equal outlay.

A bill has been introduced in the Utah legislature, and passed the senate with only two dissenting votes, appropriating $10,000 for cooperation with our investigation in continuing these studies for the next two years.

In Idaho, Montana, Wyoming, Nebraska, and Colorado we cooperated with the State engineers' offices and State experiment stations in carrying on investigations similar to those outlined for Utah.

In Texas, Kansas, Nebraska, and the Dakotas, and in sections of many arid States, agriculture will depend in large measure on a combination of irrigation and dry farming. Here the well and small reservoir will in time be relatively as important as they are in India, where 13,000,000 acres are irrigated from wells and 8,000,000 acres from tanks or small storage basins. It is my belief that the well and small reservoir are destined to water a large area in the arid and semi-arid West. The average cost of windmill irrigation in Kansas last year, including expenses for maintenance and operation and interest on the outlay at 7 per cent, was about $6 per acre. The value of the crops grown ranged from $20 an acre for alfalfa to $300 an acre for sweet potatoes. The area irrigated by a single mill varied from an average of 2 acres for the 8-foot mill to 8 to 9 acres for the 25-foot

mill. Whatever are the possibilities of this kind of irrigation, they ought to be determined and the facts given the widest publicity at the earliest possible moment, because thousands of farmers have already gone into a country where this kind of irrigation may be their salvation.

In Texas, Kansas, Colorado, eastern Wyoming, western Nebraska, and the western half of North and South Dakota, as well as much of Montana, men are settling where success must depend on a union of the most advanced practices in dry farming combined, wherever feasible, with the irrigation of small areas. There has been an enormous emigration to this section during the past two years. Along every railroad line reaching into that territory settlement has extended farther and farther west, much as it did in 1884–85. The permanency and prosperity of this settlement are not yet assured. It will be a failure if these farmers attempt to grow the same crops and in the same way as in the East. I believe it will be a success if farmers learn how to conserve moisture in the soil and grow crops suited to that region. This means an evolution in agriculture. In its best form it means the combination of a comparatively large area, varying from a quarter section to a section, to be cultivated by rainfall, with 5 to 20 acres of land irrigated.

The managers of railways traversing this territory are alive to the importance of demonstrating how its resources can be best utilized. They appreciate that the prosperity of the farmers along their roads means their own prosperity, while the failure of these farmers is certain to reflect on their own receipts. Believing in the practical value of the work we are doing, the Union Pacific, Burlington, Colorado Southern, and Northern Pacific railways have each volunteered to aid in testing the feasibility of irrigation by pumping and small reservoirs when combined with dry farming, if this Office will undertake to direct the experiments.

A number of farmers in North Dakota have indicated a willingness to undertake this sort of irrigation if the methods can be explained to them, and a bill making an appropriation for this work has been introduced in the legislature of that State.

We went about this work in the following manner: In Texas three field agents were employed in 1904. They were all trained engineers. Two had had extensive experience in California in the operation of pumping plants for irrigation. One had been engaged for several years as an instructor for beginners in irrigation. Their duties were two fold: First, to give personal advice and direction to beginners as to how to go about irrigating their crops; next, to study the resources of the country, to determine its possibilities, and to ascertain the cost of irrigation and the value of the crops produced. The most valuable feature of the season's work was the personal direction given to beginners in irrigation. In some instances the farmers gathered together in towns and were told how to prepare their land, how to apply water, how to install pumps, and how to care for them. We have had numerous letters from these farmers expressing their appreciation of this service, and stating that through it they had changed their original plans and saved a large amount of money thereby.

IRRIGATION IN THE HUMID STATES.

We have been accustomed to consider irrigation as of importance to the arid portions only of the country, but we are beginning to realize that it is to have a large field of usefulness in the East, especially to market gardeners and the growers of high-priced products. Doctor True has referred to the remarkable extension of irrigation along the Gulf coast. It will in time have a similar development throughout the entire South wherever water can be had at a depth of less than 50 feet. Although irrigation is far more expensive in the East than in the West, the average cost per acre according to the census bulletin being $100 as against $10 for the arid region, nevertheless it has proven profitable. I do not know of a market gardener who has once installed an irrigation plant who has abandoned it, although there are occasional seasons when it is not used, and we have records showing that the number of new irrigation plants established each year is growing rapidly.

The CHAIRMAN. Now, the committee would like to hear from you very briefly on certain other matters—for instance, what have you done to aid irrigation in connection with rice culture in Louisiana, and what have you done as to irrigation in the East?

Mr. MEAD. Here is the first of our bulletins [exhibiting same] on rice irrigation in the South, and that was practically a study of what were the conditions in the rice districts. That study disclosed the fact that there are two questions connected with the development of the rice industry that will affect its continual prosperity. One is the determination of the type of pumps that will lift the water at the least cost, and the other is the determination of the quantity of water that will give the best results. The tendency of irrigators in the rice districts is to use too much water. Too great a depth of water on rice fields retards the action of the sun in heating the soil, makes the growth slower and the stalks weaker and more liable to be broken. The increased depth of water increases seepage, and as all the water has to be drained off at certain times of the year, it increases the cost of pumping, because the more water drained off the more has to be lifted to replace it.

We have also been studying the effect of salt water on the growth of rice and its influence on the subsequent productiveness of fields to which applied. The slight fall of the streams flowing into the Gulf causes salt water to flow upstream for considerable distances when the water is low and large demands made on the streams by the pumps, and in dry years water containing a considerable percentage of salt water has at times been applied to crops. Our conclusions are that water containing a considerable percentage of salt can be applied safely to plants having considerable growth, but will injure very young rice. If not continuously applied it is not likely to have any injurious effect on the soil, because the rains of subsequent years wash the salt all out.

We are also aiding to determine what can be done in growing rice in districts where it has never been tried. Last year we carried on experiments in rice growing in central Arkansas, in the region between Little Rock and the Mississippi River. A district here between 90 and 100 miles long and 30 to 40 miles wide is not well

uited to growing wheat and cotton, but seems to be well adapted to ice. Last year the yields were from 60 to 90 bushels per acre.

The CHAIRMAN. You did some work also in the Carolinas?

Mr. MEAD. Yes, sir. We have made some surveys to determine he cost of providing a supplemental water supply for Cooper River, nd some investigations of improvements in methods of building evees and protecting rice fields from freshets. It is difficult, howver, to deal with the situation in the Carolinas because they are uffering from a number of causes that are widespread. The matter f stream management we hope to take up and study thoroughly n the near future.

One of the difficulties which the rice planters have to contend vith is higher water in freshets and lower water during droughts han formerly prevailed. This is due to cutting off the upland imber and the erosion of soil into the streams, filling up their chanels, through the cultivation and washing of the hill lands. Higher vater in freshets means higher levees, and these in some places ave been raised to the limit of safety. The danger now is that uring floods the pressure of the water will cause breaks inside f the levee banks.

The CHAIRMAN. Have you not done some work in New Jersey lso?

Mr. MEAD. Yes, sir.

Mr. COOPER. How far north in the Mississippi Valley--in what atitude would it be practicable to grow rice?

Mr. MEAD. It is difficult to say just how far it can be grown profitbly. They raise rice in Italy in the same latitude as St. Paul, Minn.

Mr. COOPER. That is on the Mediterranean?

Mr. MEAD. No; it is in the interior.

The CHAIRMAN. In the valley of the Po?

Mr. MEAD. Yes.

Mr. UNDERWOOD. I have shot ducks in rice fields in northern Minnesota, but that is not the same kind of rice, I take it.

Mr. MEAD. I believe rice will grow up to the northern boundary f Arkansas.

Now, taking up the question of the chairman regarding our vork in irrigation in the East, there are two lines where irrigation vill in time be of large importance. One is the irrigation of market ardens, including cranberries, which is a part of market gardening, nd the other is the irrigation of both garden and field crops in the outh. Wherever water can be had in the South at less than 50 eet below the surface, it is going to be profitable to irrigate by umping, because this will make it possible to grow an additional rop each year. You can grow a crop after the first one is harvested f there is water enough to give it an immediate start and keep it rowing. The conditions in the South are very much like those in taly, where with 40 inches of rainfall they spend as high as $200 n acre over large areas to provide an additional water supply. They do this because without irrigation the second crop could not e grown. It would be burned out by the intense heat of the sumner.

Irrigation also aids the scientific rotation of crops and enables the armer to maintain the fertility of his land.

In many parts of Italy, as in the South, irrigation is needed to perpetuate meadows and pastures.

Irrigation has proven to be very profitable in the production of tobacco. I have recently received a list of 50 people who are irrigating garden and field crops in one county in Florida. The extension of irrigation in this section during the past three or four years has been very marked.

Mr. REEDER. They grow a new kind of tobacco there which they are not able to grow by the ordinary process?

Mr. MEAD. I do not know about that. Our work in aiding irrigation in the South has thus far been confined to advising farmers about the kind of pumping machinery they should install and the methods of distributing water over their land. In Georgia, Alabama, and Mississippi farmers are beginning to irrigate field crops, but they need advice about the amount of water required for an acre of land in order to secure pumps and engines and pipe of the right dimensions.

The CHAIRMAN. You have undertaken some work in Texas, Kansas, and other places?

Mr. MEAD. Yes, sir.

Mr. TRUE. It ought to be said also, Mr. Mondell, that there is already quite a little irrigation in New Jersey, Massachusetts, and Connecticut by market gardeners. That is growing from year to year.

Mr. MEAD. Yes. Here [exhibiting bulletin] is a report on irrigation in the humid sections of the country, prepared two years ago. We now have three or four times as many districts where irrigation is important as there were when this report was prepared. The next bulletin will be much more comprehensive and instructive.

I will supplement what was said earlier in this statement by explaining that this year we expect to prepare a report on the methods of building small reservoirs, using our field agents in the same manner as described Saturday for collecting the information. Through the courtesy of the management of the Chicago and Northwestern Railway lines west of the Missouri River, we are to have the benefit of the experience gained by this railway in building a large number of reservoirs to provide stock water in the arid region. They have maintained and operated these reservoirs for several years and have in their possession the details of the first cost and some valuable information regarding the problems encountered in protecting and maintaining reservoirs. One feature of this experience will serve as an illustration. The reservoirs which were so built as to have the embankment on the eastern side have cost far more to maintain than those where the embankment was on the western side. That is because the prevailing winds drive the waves against the bank when on the eastern side and away from the bank when on the western. Banks on the eastern sides of their reservoirs have had to be riprapped and constantly repaired. Banks on the western side have required no protection.

The CHAIRMAN. Now, Mr. Mead, the hour of 12 o'clock has arrived.

Mr. MEAD. I have appreciated, Mr. Chairman, the opportunity to appear before your committee.

The CHAIRMAN. We are much obliged to you for your statement, and we have all been glad to hear it.

Mr. MEAD. I should like to make one brief explanation. The question has been asked as to the manner of distributing our bulletins. I have sent a number of these bulletins to the members of the committee, together with a list of the bulletins which are now available, and I should like to have one of these lists inserted with my statement. They are marked with the price charged by the Superintendent of Documents, but those sent directly from the Department are sent free.

The CHAIRMAN. They are sent on request?

Mr. MEAD. Yes, sir. No charge is made for those sent directly from the Department.

Thereupon, at 12.05 p. m., the committee adjourned.

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